JAN 9 1924

Motorship

New York Seattle San Francisco

JANUARY, 1924

MARINE DIESEL ENGINES
FOR ALL CLASSES OF SHIPS

M. S. MUNCOVE
Length 353'6", Width 43'6", Depth 27'6"
Draft 23'6", Deadweight Capacity 4125 Tons
Single Screw, 1200 I.H.P., Oil Engine

McINTOSH & SEYMOUR CORPORATION
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Eng.
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EXCLUSIVE technical and non-technical articles on design, construction and operation of oil-engines and motorships by the world's foremost writers on marine engineering.

Motorship

PROFUSELY illustrated with photographic reproductions of the newest designs in international merchant motorship and Diesel-engine construction and auxiliary equipment.

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Union Castle Line Orders Record Motor-Liner

Diesel-driven Passenger Liner of 30,000 tons Displacement and 20,000 Horsepower to be Built by Harland & Wolff

A twin-screw motor passenger liner of 30,000 tons displacement, 20,000 tons gross and 20,000 indicated h.p. has been ordered by the Union Castle Mail Steamship Co. for its British-South African service, advise Harland & Wolff, of Belfast, in a recent communication to MOTORSHIP. This remarkable vessel is being laid-down on the berth occupied until recently by the motorship LOCHINVAR—which took the water during December—and will be launched in 1925. The yard number is 595. In many respects, with the exception of the engine-room, she will resemble the ARUNDEL CASTLE, also a Harland & Wolff production, but will be more modern in her general equipment. The propelling plant of this huge motorship will consist of two sets of Burmeister & Wain type four-cycle Diesel engines, each having eight double-acting cylinders, and an output per cylinder of 1,250 i.h.p. Thus the total power on twin screws will be 20,000 i.h.p., or approximately 16,000 shaft horsepower on twin screws without any reduction gear or other form of transmission.

The placing of this order is noteworthy, because not only does it show the tendency of European shipowners at the present time to back up the orders for the large motor-liners placed by the Royal Mail Line, Union Steamship Co., N. Z., Rotterdam-Lloyd and Swedish-American Line, etc., but it also demonstrates the confidence in the practicability of Diesel-engined vessels of the larger size and that they intend to keep their large fleets sufficiently up-to-date to be in the van of progress.

Lord Kylsant, Chairman of the Union Castle Line, has shown considerable vision and has supported it with the courage of his convictions, not only by adopting oil-engine power, but by constructing new tonnage in anticipation of busier times to come. The motorships recently ordered in Great Britain have been a godsend to shipbuilders. Had the majority of American shipbuilders developed the Diesel engine to a greater extent than they have done, and had they preached the gospel of economy of Diesel power to our shipowners, we think that our yards would be busy at the present time constructing this class of merchant vessel.

Lord Kylsant is also Chairman of the Royal Mail Line, which recently ordered two 22,000 tons Diesel-driven passenger liners for their England-Pacific Coast of America service. These magnificent ships will both be propelled by twin eight-cylinder four-cycle double-acting Harland-Burmeister & Wain oil engines of 8,150 i.h.p. each, or 16,300 i.h.p. per ship, similar to those building at Copenhagen for the Swedish-American motor-liner "GRIPSHOLM." This order is a worthy recognition of the Royal Mail Line's 84th anniversary. These vessels will be equipped with every modern luxury and convenience from a passenger point of view, besides providing large accommodation for the carriage of refrigerated cargo in the shape of chilled meat, butter, fresh fruit, etc. Together with the

SOME OF THE LARGEST MOTORSHIPS NOW BUILDING IN EUROPE

(Arranged in Order of Horsepower)

OWNERS	Tonnage	Horse-power (indicated)	Type	Name of vessel	Hull builder	Speed	Approximate daily fuel-consumption	Type of Diesel (cycle)	Make of engine
Union Castle Line	30,000 d. p. / 20,000 g.	20,000	Passenger	Union Castle	Harland & Wolff	18 kts.	70 tons	4	Harland-B. & W.
Royal Mail Line	22,000 g.	16,300	Passenger	Asturias	Harland & Wolff	16 kts.	50 tons	4	Harland-B. & W.
Royal Mail Line	22,000 g.	16,300	Passenger	Amazon	Harland & Wolff	16 kts.	50 tons	4	Harland-B. & W.
Swedish American Line	23,500 d. p. / 17,000 g.	16,300	Passenger	Gripsholm	Armstrong-Whitworth	18 kts.	50 tons	4	Burmeister & Wain.
Union Steamship Co., New Zealand.	17,000 g.	13,900	Passenger	Aorangi	Fairfield Shipbuilding.	17 kts.	47 tons	2	Fairfield-Sulzer.
Brazilian National S. S. Co.	8,500 g.	7,800	Passenger and cargo.	Unnamed	Brazilian National S. S. Co.	15 kts.	24 tons	2	Sulzer.
Rotterdam-Lloyd Line	12,000 g.	7,000	Passenger and cargo.	Unnamed	De Schelde Co	14 kts.	22 tons	2	Schelde-Sulzer.
North German Lloyd	9,450 g.	6,500	Passenger and cargo.	Unnamed	Vulcan Works	13½ kts.	20 tons	4	Vulcan-Augsburg (Reduction Gears).
Royal Mail Line	19,300 d. p. / 9,500 g.	6,400	Passenger and cargo.	Lochmonar	Harland & Wolff	13 kts.	19 tons	4	Harland-B. & W.
Hamburg South-America Line.	12,000 g.	6,000	Passenger and cargo.	Unnamed	Blohm & Voss	13 kts.	18 tons	4	B. & V.-Augsburg.
Elder Dempster Line	9,000 g.	6,000	Passenger and cargo.	Unnamed	Harland & Wolff	13 kts.	18 tons	4	Harland-B. & W.
Ocean Steamship Co.	12,000 d.	6,000	Cargo	Unnamed	Harland & Wolff	13 kts.	18 tons	4	Harland-B. & W.
Axel Bröstrom	22,000 d.	6,000	Ore-carrier	Unnamed	Deutsche Werft	11 kts.	18 tons	4	A. E. G.-B. & W.
Axel Bröstrom	22,000 d.	6,000	Ore-carrier	Unnamed	Deutsche Werft	11 kts.	18 tons	4	A. E. G.-B. & W.
German-American Pet. Co.	14,000 d.	6,000	Tanker	Unnamed	Howaldtswerke	11½ kts.	18 tons	2	Sulzer.
Nippon Yosen Kaisha	10,000 d.	5,500	Cargo	Unnamed	Harland & Wolff	12 kts.	16 tons	4	Harland-B. & W.
Nippon Yosen Kaisha	10,000 d.	5,500	Cargo	Unnamed	.....	12 kts.	16 tons	2	Sulzer.
Messageries Maritimes	10,300 g.	5,400	Passenger	Unnamed	Chantiers de France	14 kts.	15½ tons	2	Sulzer.

g. (Gross tonnage). d. (Deadweight tonnage). d. p. (Loaded displacement). Total = 18 ships. Average power per ship = 9,038 i.h.p.

V.B.

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other motor-liners they will mark a definite epoch in the history of marine propulsion.

Through the adoption of the double-acting type of four-cycle engine by Harland & Wolff in conjunction with Burmeister & Wain, most marked progress has been made, it now being possible to provide power for the largest mail and passenger vessels afloat. When the news of the Union Castle Line order was conveyed to General Smuts, Premier of the Union of South Africa, he expressed great satisfaction, as well as being pleased with the prospect of the additional transportation facilities to South Africa.

As an indication of the remarkable strides that are now being made in Europe in connection with the construction of large high-powered motorships, we publish on this page a complete list of such vessels. A somewhat similar list was published in MOTORSHIP about six months ago, but some of the vessels on the same are already in service. Our revised list contains additional ships ordered, including the Union Castle liner, and eliminates those put in service.

The new liner "UNION CASTLE" will be the most powerful motorship afloat or yet under construction, and next in gross tonnage to the two motor-liners for the Royal Mail Line. Her dimensions are as follows:

Loaded displacement	30,000 tons.
Gross tonnage	20,000 tons.
Power	20,000 i.h.p.
Power	16,000 s.h.p.
Length	630 ft.
Breadth	73 ft.
Depth	46 ft.
Daily Fuel Consumption	70 tons.

Luxurious accommodation will be provided for a large number of passengers and the absence of up-take obstruction necessary with a steamer increases and improves the sizes of the various public rooms.

We presume that the daily consumption of fuel-oil will be 65 tons for the main engines at full speed, and another 5 tons for the auxiliary machinery, or a saving of about 180 tons per day over her sister steamships the ARUNDEL CASTLE, etc. This means that not only will there be accommodation for more passengers, but a considerable additional amount of cargo can be carried amounting to several thousand tons — thus providing much greater revenue as well as a big reduction in operating costs, aside from dispensing with firemen.

Closest collaboration of Burmeister & Wain with Harland & Wolff, and continued tests of the experimental double-acting Diesel engine of similar cylinder output, have enabled the builders to feel confident of the utmost reliability of the new motorship when completed and of the striking advance in power that is made without increasing the cylinder diameter more than a few inches above that of the single-acting Diesel engine cylinders in common use among about 125 Burmeister & Wain type engined cargo ships. Everything indicates that the new engine has been designed on sound straightforward lines and thoroughly tested.

The piston is cooled by means of telescopic pipes worked off the crosshead. The piston rod is entirely surrounded by a cooled cast iron sleeve, which has the effect of protecting the rod itself from all contact with the gases, and, at the same time enables an exceptionally simple stuffing-box to be provided, the absolute reliability of which has been proved by prolonged tests at full power. It will be appreciated that this construction eliminates the effects of corrosion and adverse heat treatment of the piston rods, which have previously been considered a source of anxiety in double-acting internal-combustion engines generally.

One of the questions which engineers have always expected in the application of the double-acting principle to Diesel engines was the assumed difficulty of providing stuffing boxes that would be satisfactory under the conditions of prolonged service; also the problem associated with the fuel valve having to be placed away from the centre of the cylinder. The designers have got over both these difficulties satisfactorily, and we can say so with confidence in view of the prolonged tests which have taken place during the past twelve months on the full size experimental engine.

As a matter of fact, except for these new features associated with the double-acting engine, the other constructional features of the engine are very similar to the normal single-acting Diesel engine which has been doing such good work under ordinary service conditions during the last 10 or 12 years.

The characteristic types of fuel, starting and exhaust valves and fuel pumps used in the single-acting engines have been retained in the new double-acting design. Also the general layout of push rods for operating the valves, cam shaft with double cams for ahead and astern running, weigh shafts for removing and replacing the rollers during manoeuvring and the familiar reversing gear, all follow the firm's standard practice in all essential details. Each engine drives its own twin three-stage air compressor off the forward end of the crankshaft.

A comparatively small flywheel or turning wheel with electrically driven turning gear is provided aft and Michell thrust blocks will be provided.

The auxiliary machinery will consist of four single-acting Diesel generator sets, accommodated in a separate compartment forward of the main engine room. Here also will be fitted the main fuel settling tanks.

The pumps for circulating salt water, fresh water and lubricating oil in the main engine room, and in fact all the auxiliaries in the machinery spaces as well as for deck purposes will be electrically driven. Electrical power will also be available for cocking, fans, heating, etc. The generator sets provided with their attendant, auxiliary gear and switchboards constitute a power plant, comparing favourably as to size with that of many a fair sized town.

Bank Line Orders Twenty-One Big Motorships

British Government Loan-Subsidy of $8,000,000 Guaranteed for the Construction of Large Diesel Fleet

EXTRAORDINARY steps are being taken by the British Government in conjunction with her shipowners and shipbuilders to ensure that Great Britain will maintain her tonnage supremacy in the construction of modern and up-to-date oil-engined motorships. It was only recently that the Government granted a loan of nearly $10,000,000 for the construction of two 22,000 tons gross Diesel-driven passenger liners for the Royal Mail Line. This has been supplemented by the guarantee of a loan of $8,000,000 to Lord Inverforth's Bank Line (managed by Andrew Weir & Co., of Glasgow) and to Harland & Wolff, the well-known shipbuilders, towards the construction of a fleet of 19 motorships which will be turned out shortly.

In addition to this subsidy a certain amount will be loaned as an aid to the construction of steamships, the sum of $1,760,000 having been loaned to the Atlantic Transport Line, as well as two loans of $162,800 and another of $88,000 to Clyde shipowners.

A number of these new motor vessels are already in hand, including the GUJARAT illustrated on next page, and the KATHIAWAR, launched on Nov. 22nd. at the Harland & Wolff Govan shipyard.

According to "FAIRPLAY" of London, there will be 21 of these motorships altogether, if one includes all the Bank vessels now in hand. This is a record order for motorships and much is due to the enterprise of Lord Pirrie and Lord Inverforth. It is supplemented by a similar action on the part of Lord Kylsant, Lord Inchcape, and Sir Frederick Lewis, in ordering among other motorships a 30,000 tons displacement, 20,000 h.p. Diesel-driven liner for the Union Castle Steamship Co., and two 22,000 tons gross motor-liners for the Royal Mail Line as discussed elsewhere in this issue. It absolutely demonstrates that they are thoroughly satisfied that the Diesel engine has now reached the point where it can be installed with confidence and with safety in almost the largest sized Transatlantic liners. And, that developments and experiments have reached the stage where wholesale adoption involves practically no risk. Deals of such magnitude must be of incalculable value to Clyde and Belfast shipyards and will do much to stimulate British Diesel engine construction.

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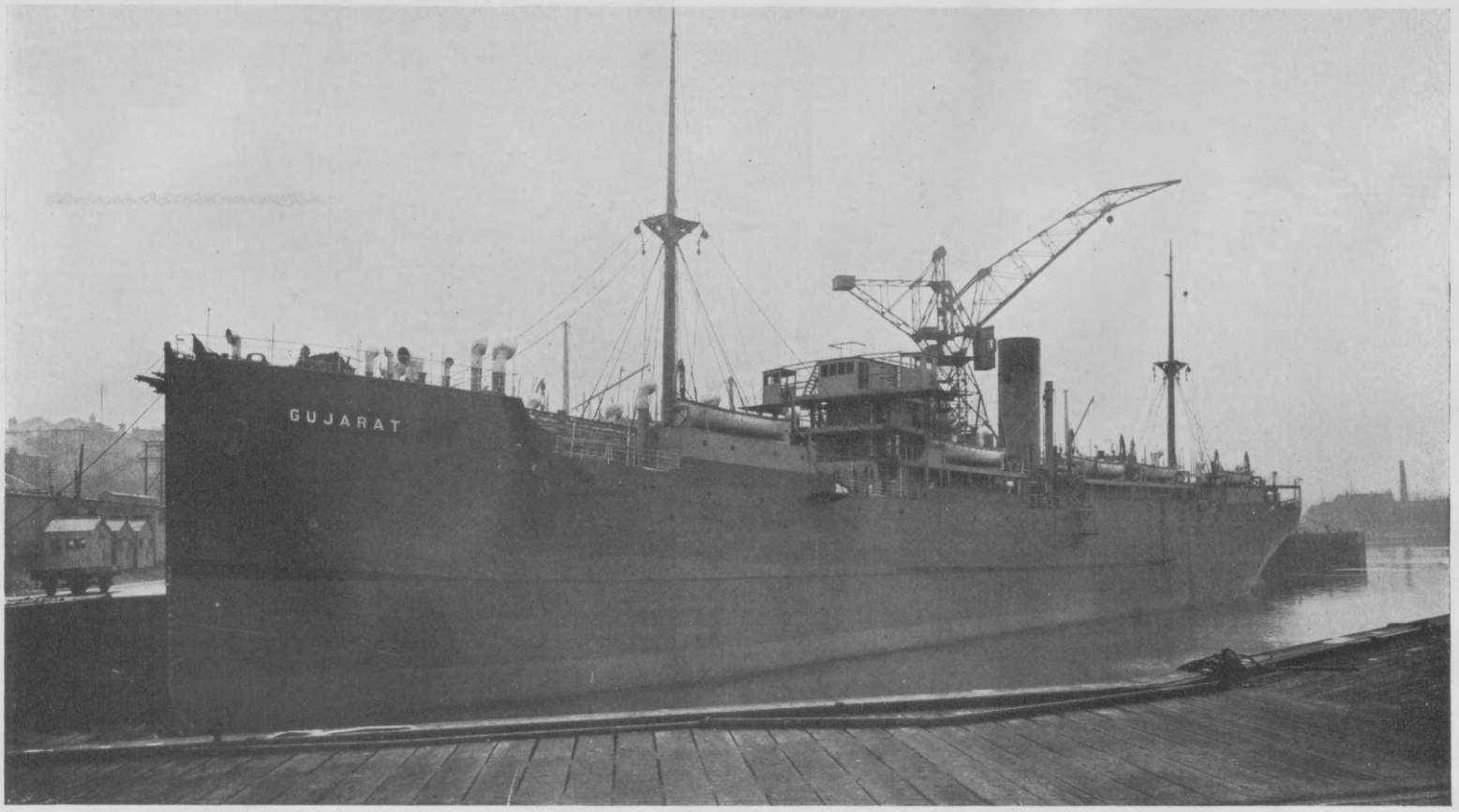

Bank Line motorship "Gujarat," one of 21 large Diesel-driven freighters building, and just ordered under British Government loan

These are not the only liners building in Great Britain, as there is the larger vessel building at Armstrong-Whitworth's for the Swedish-American Line, the engine for which is building by Burmeister & Wain. The various loans referred to above are being carried out under the Trade Facilities Act, including for the motorship LOCHMONAR.

Referring to the motorship KATHIAWAR, which has just been launched at the Govan shipyard for the Bank Line, she is intended for Andrew Weir's Calcutta-South African service, as is the GUJARAT. Her dimensions are as follows:

Gross measurement	4,320 tons.
Speed	10 knots.
Length	384 ft.
Breadth	48 ft.
Depth	36 ft.
Classification	Lloyds 100A1

She is a single-screw vessel and will be propelled by a six-cylinder Harland & Wolff-B.&.W. type four-cycle Diesel engine, and will have electrically-driven auxiliaries throughout. She is a shelter deck vessel with 7 water-tight bulkheads. Accommodation is provided at the after end for 28 second-class native passengers between decks, as well as additional space for native passengers or storage of cargo, between decks. Accommodation is also provided for 12 first-class passengers, including dining saloon, bathroom, etc. and the usual quarters for the captain, officers, engineers and crew. There are ten electric cargo winches, a warping winch, electric windlass and electric steering gear with telemotor control.

Two Years' Ferry Service on Hudson River

Ingersoll-Rand Oil-Engined Ferry-Boat HUDSON ATHENS is Proving Her Worth by Steady Operation

JUST about 30 miles below Albany on the historic Hudson River are located the incorporated township of Athens and the City of Hudson, which between them have a population of 16,000 inhabitants. According to some writers it was at this point that Henry Hudson ended his voyage northward on the HALF MOON. These two towns are located on the west and east banks respectively, the road through Athens running westward to the Catskill Mountains, while from Hudson there is an almost direct route to the Berkshire Hills. Consequently, thousands of automobilists and other tourists pass through these riverside towns every year, many crossing the Hudson.

In the January issue of the COMPRESSED AIR MAGAZINE, published by the Ingersoll-Rand Co., builders of the well-known Ingersoll-Rand oil-engines, Robert Skerrett tells the story of how the motor ferry-boat HUDSON ATHENS came into being. This interesting vessel is 115 ft. overall, 90 ft. long on the water line, 44 ft. maximum breadth and 7½ ft. loaded draft. She is powered with a six-cylinder 11 in. by 15 in. Ingersoll-Rand oil-engine of the Price-Rathbun four-cycle type, having a rated output of 220 shaft h.p. at 230 r.p.m. direct connected to the fore and aft propeller shafts. She was built from designs by Eads Johnson, Naval Architect, of New York, and can carry 270 people, as well as 30 motor vehicles. In the engine-room furnishing auxiliary power, there is a 15 b.h.p. Mianus Leissner-type oil-engine driving an Ingersoll-Rand emergency air-compressor at one end and a Goulds rotary pump at the other end. Also driven by this little oil-engine is a 3½ k.w. electric generator operated from the flywheel of a belt. It supplies current for lighting. There is a fuel-oil capacity of 1,000 gallons. Wm. H. Hoffman is her chief-engineer.

The responsible officials of the Hudson and Athens Ferry Company were fully alive to the trend of events when they decided, more than two years ago, to dispose of their old steam-driven, side-wheel ferryboat GEORGE H. POWER and to put upon the route a thoroughly modern craft capable of taking care of both the passenger and the augmenting vehicular traffic. It is interesting to recall here that the service is maintained agreeably to separate franchises granted by each of the communities concerned. This situation has had its drawbacks in the past, and led to an amusing but momentary embarrassment about 54 years ago. In 1858, the J. T. WATERMAN was put on the line, and for a decade that unpretentious vessel journeyed in a leisurely fashion to and fro between Hudson and Athens, and answered fairly well in the days when the ox cart and the horse-drawn vehicle were the accepted order of conveyance.

But in 1869, one of the towns protested and demanded an improvement — in fact, insisted that the route be equipped with a larger boat, two feet wider and ten feet longer than the J. T. WATERMAN. There must have been a "sea lawyer" somewhere

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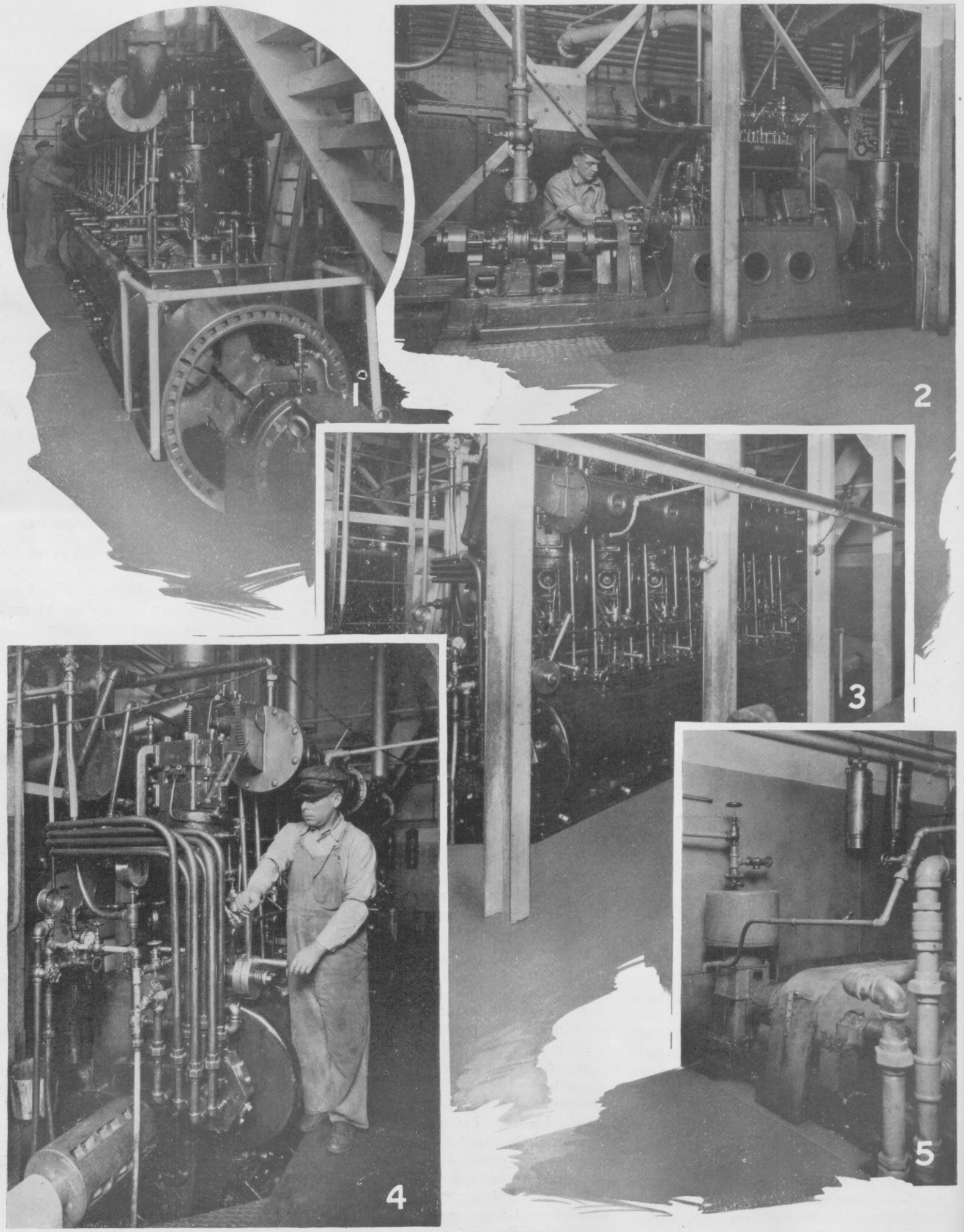

ENGINE-ROOM OF FERRY-BOAT HUDSON ATHENS

(1) Ingersoll-Rand 220 shaft h.p. propelling oil-engine. (2) The 15 b.h.p. Mianus oil-engine which provides auxillary power. (3) View of exhaust side of the main unit. (4) Control of the engine when maneuvering is by the single lever held by the engineer. (5) A two-stage Ingersoll-Rand compressor for the main-engine maneuvering air.

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The Ingersoll-Rand powered Hudson-Athens motor ferry-boat which has replaced the old steam ferry George H. Power

in the background, because it would have been a comparatively easy matter to lengthen the old ferry, but she could not have been broadened without entirely rebuilding her. As a result, a new hull of the prescribed dimensions was constructed and into it was put the WATERMAN'S engine. This craft was named the GEORGE H. POWER, and served the neighboring communities until she was displaced by the present oil-engine-driven, propeller-type ferry HUDSON-ATHENS.

During the open season, the HUDSON-ATHENS makes 25 round trips every weekday and 23 round trips on Sunday; and during the two years the boat has been in service she has maintained her schedule with the exception of one trip, and that failure was in no wise attributable to her main engine.

The hull and the center casing are of steel, and these were constructed by the Anchor Shipbuilding Company, Washburn, Wis., where the vessel was launched July 4, 1921. In order to make it possible for her to pass under the bridges spanning the New York State Barge Canal, the center casing was not erected until the craft reached Hudson. During the 2,000-mile voyage eastward from Washburn, the crew lived in temporary quarters built for them on the main deck; and the boat was also navigated from a steering station provided for the time being on the same deck. The HUDSON-ATHENS covered the whole distance under her own power, and accomplished the journey without mishap of any sort.

After reaching Hudson, the center casing was erected; the superstructure and the cabin built; and other finishing work done by carpenters, etc., drawn from a local shipyard. But, owing to various delays in carrying out these jobs, ice several inches thick formed on the river before the ferry was ready for service. The management decided not to put her on the run until the spring of 1922. In passing, it might be remarked that an operating season covers a period of from 10 to 10½ months — depending upon the severity of the winter and the thickness of the ice in the river. While the HUDSON-ATHENS has broken her way on occasions through ice four or five inches thick, still the company is not required to keep her in commission when ice interferes with traffic.

On entering a ferry slip, the engine can be slowed down to 40 r.p.m. While no record has been kept of the number of engine maneuvers required on each trip, it is believed that they average not less than eight, and this would mean, in the course of ten months, let us say, a total of 120,000 maneuvers. Plainly, an engine, to satisfy service demands of this nature, must have a dependable and, withal, a decidedly simple reversing mechanism — otherwise there would be trouble and probably breakdowns.

It should be pointed out here that there are no clutches between the main engine and the propellers which, by the way, are, respectively, right and left-handed screws that operate in unison — one drawing the boat forward while the other drives, and vice versa. Accordingly, any movement of the direct-connected engine turns the wheels. In the absence of clutches, it is essential that the engine, itself, be capable of speedy reversing; and the fact that the engine in question meets this requirement fully brings us to one of the most commendable of its features.

Opening and closing of the intake and the exhaust valves are symmetrical with

Thirty automobiles can be accommodated on the spacious main deck of the Hudson-Athens, in addition to foot passengers on the upper deck

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respect to the top and the bottom dead-centers, and the number of degrees the values are held open is identical. When the direction of rotation of the engine is reversed, the functions of the exhaust and the inlet valves are automatically interchanged. Since there is no camshaft to be rotated, the operation of reversing consists simply in bringing the engine to a stop and then in moving the air-starting cam through an arc of 60 degrees — this maneuver serving to admit air to that particular cylinder whose crank is at the moment in a position to rotate the engine in the opposite direction. Hence the engine can be stopped, started in either direction, and its speed altered by the movement of a single lever, which is so placed in relation to the center-line of the craft that its handle always points in the direction of travel if the boat is underway. The engineer's task is, therefore, a very light one; and he exercises complete command over his charge with a minimum of effort and with a certainty of proper response.

The question will naturally arise in the minds of many that are familiar with oil engines: Isn't such a system of reversing apt to prove harmful to the exhaust and the intake valves? Chief Engineer Hoffman declares the results to be quite the opposite. He claims that the intermittent cooling and heating of the valves actually increase their service life; and he bases his conclusion upon the condition of the engine's valves after it had performed for twenty months and covered substantially 55,000 engine-miles. During that interval it was necessary to replace only one valve, and that valve, had time permitted, could readily have been made fit for use again.

While it is the practice of the chief engineer of the HUDSON-ATHENS to grind all valves at the end of an operating season, it is also his custom to grind them at least once during the active season. In this connection, he says — "The last cylinder on which we ground valves has made 10,000 miles, and upon opening up the cylinder in question we found the valves quite capable of doing an additional 1,000 miles just as they stood. I credit this remarkable performance to the fact that the exhaust valves are not run continuously at high temperatures."

The crank-shaft of the main engine extends at both ends of the engine and is connected to the intermediate shafting by means of muff couplings; and a double Kingsbury thrust-bearing is fitted at only one end of the prime mover. When the boat is moving in one direction the thrust is absorbed directly by this special bearing, but when the craft is traveling in the opposite direction the thrust is transmitted through the whole length of the crank-shaft and is absorbed by the same bearing. While this procedure differs radically from regular steam-engine practice, still the Ingersoll-Rand Company are satisfied that the departure is a technically correct one with this particular type of oil engine, and the results bear out their contention. That company argues that inasmuch as an oil-engine crank-shaft is of so much larger diameter than that of a steam-engine of similar power, and as the propeller thrust is small compared with the other stresses acting on it, there is, therefore, no warrant for installing an additional thrust bearing. As a matter of fact, no trouble of any kind has developed with the crank-shaft since the ferry began its service, and no main or crank-pin bearing has been wiped.

Three More Winton Diesel-Engined Tugs

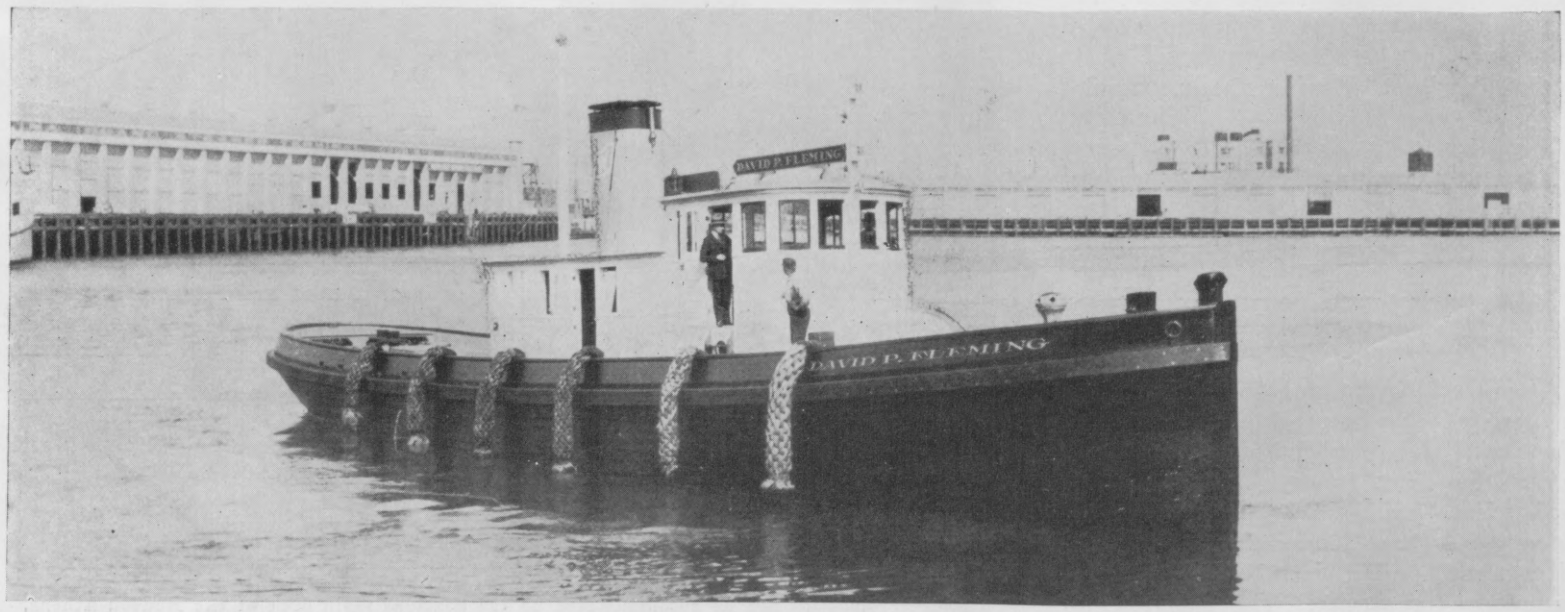
Two for the Wilmington Transportation Company, and One for the American Dredging Company

IN every issue we record the news that orders have been placed for additional oil-engined tugs and that new vessels of this class have run trials. On this page we illustrate the motor tug DAVID P. FLEMING just completed by Capt. Carl Muller for the Wilmington Transportation Co., of Los Angeles, Calif., and powered with a six-cylinder 350 shaft h.p. Winton four-cycle type Diesel engine. She is being used for harbor service at Los Angeles and the Catalina Islands. Her length is 85 ft. by 17 ft. breadth and 10 ft. draft and 11 knots speed. In addition to her main engine, her engine-room equipment consists of one 30 k.w. Winton Diesel-electric generating set, two Winton auxiliary air-compressors, one 5 k.w. Winton Diesel-electric generating set and one Winton bilge and fire pump. A sister motor tug, also Winton powered, has just been launched. Her machinery and equipment is the same as in the DAVID P. FLEMING.

Another Winton Diesel-engined tug, which was recently launched and now nearing completion, is the ARTHUR N. HERRON, a 100 footer built by the New York Shipbuilding Corp. for the American Dredging Co., of Philadelphia. She has the following dimensions:

Length overall	99 ft. 11 in.
Length from forward side of stem to after side of propeller post	89 ft. 0 in.
Beam over outside of fenders.	24 ft. 7¼ in.
Beam moulded	23 ft. 0 in.
Depth md. from top of bar keel to top of deck beam at side amidships	12 ft. 0 in.
Mean fresh water draft	11 ft. 4 in.

This fine boat is powered with an eight-cylinder 500 b.h.p. Winton four-cycle Diesel engine, and for engine-room auxiliary power has a Winton 20 k.w. Diesel-electric generating set, two emergency air-compressors and a 5 k.w. emergency gasolene-electric generating set. No expense has been spared to make this boat a 100 per cent job, and Diesel engine manufacturers as a whole should be gratified to see the Diesel oil-engine being given a splendid opportunity to show its ability and economy as all of us know more than one good oil-engine has been ruined by a poor installation.



Motor tug "David P. Fleming," owned by the Wilmington Transportation Co., of Wilmington, Cal., and driven by a 350 shaft h.p. Winton Diesel engine

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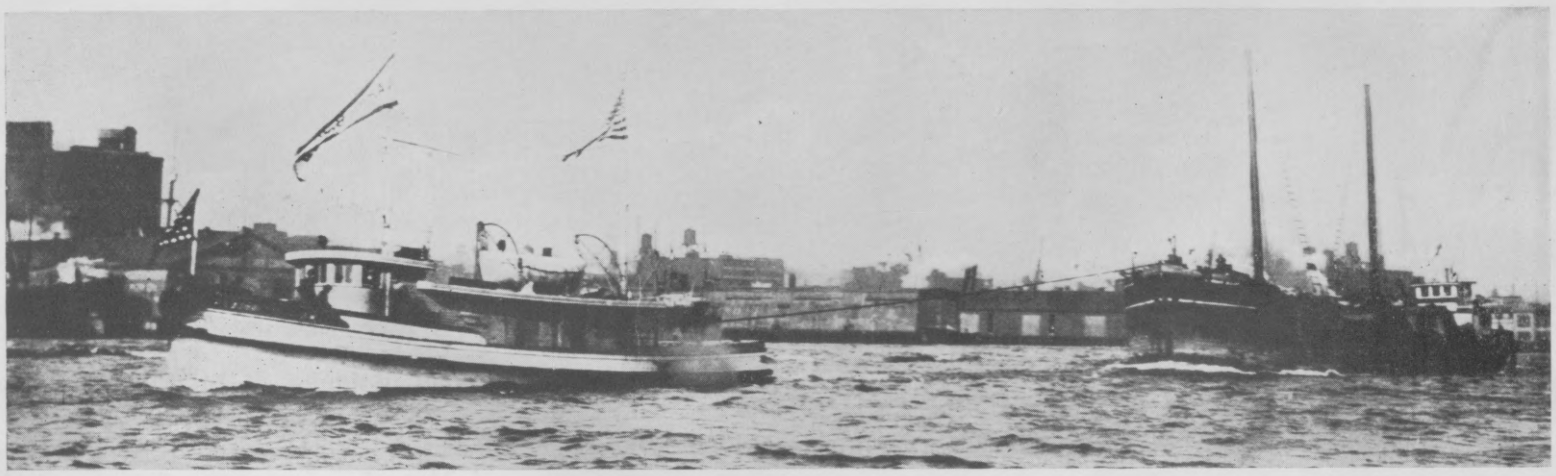
This is the largest Diesel-engined towboat built in Eastern waters during recent months. She has quarters for 14 men, while her fuel tanks have a capacity of 19,000 gallons and fresh water tanks 6,200 gallons. The hull and main deckhouse are of steel, but the pilot house is of wood. Steering will be accomplished by the American Engineering Company's electric drum-type gear operated by a 7½ h.p. motor. In the engine-room there is installed a 7 in. by 10 in. fire and wrecking pump supplied by the National Transit Pump & Machinery Co., and equipped with a 10 h.p. motor. For signalling purposes there is a Strombos air-operated syren. Heating is carried out by a low-pressure steam-driven donkey boiler.

At the launching the following officers and Directors of the vessel owners and the Captain's Association were present: Charles E. Davis, Jr., President; W. E. Bernard, Vice-President; Maurice E. Gerhard, Albert F. Brown, Thos. J. Donnelly, Harry M. Wall, and L. H. Garrison. The boat was christened by Miss Elizabeth Herron, daughter of Arthur N. Herron, General Superintendent of the Company.



Doing the work! The 200 b.h.p. Fairbanks-Morse oil-engined tug "L. B. Shaw" towing a barge on the Delaware

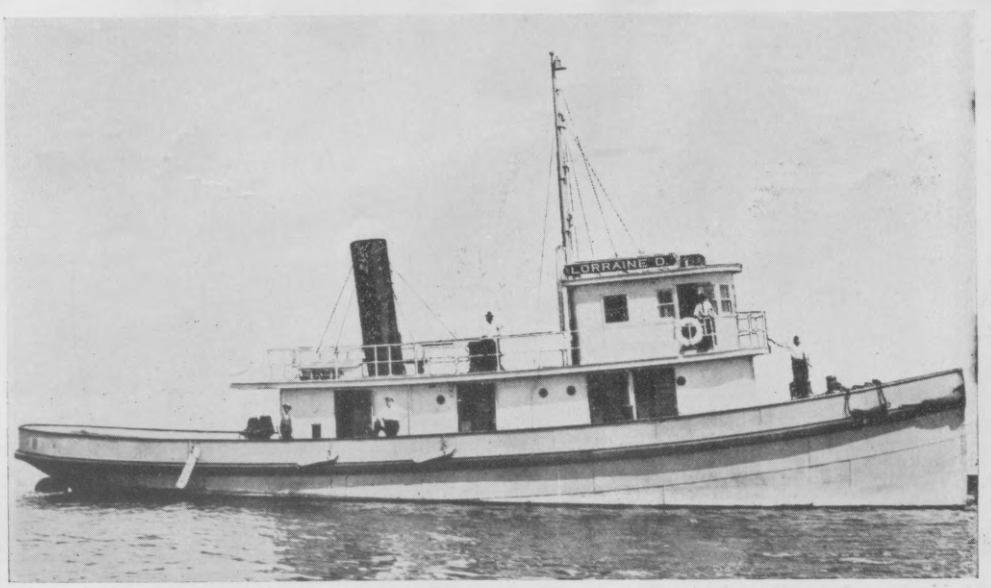
Three Philadelphian Oil-Engined Tugs

L. B. SHAW with 200 b. h. p. Fairbanks-Morse Engine is a Real Worker, as are the Tugs LORRAINE D and JESS B. SHAW

PERFORMING work more arduous than many steam tugs have to carry-out and running with even greater reliability, is the Philadelphia tug LARNIE B. SHAW, owned by Mr. L. B. Shaw, 139 South Third St., Philadelphia, and powered with a 200 b.h.p. Fairbanks-Morse oil-engine. This little boat has been in service along the Atlantic Coast, towing between Philadelphia, Boston, Mass. and over the inside route since 1919. One of our illustrations shows her towing the barge FLORENCE ELLIOTT out of Philadelphia en route for Jacksonville, Fla. The L. B. SHAW is 87 ft. long overall, 17 ft. 6 in. breadth and from 7 ft. to 9 ft. draft, according to circumstances of operation. She has a capacity for 5,000 gallons of fuel-oil, or sufficient for about 17 days' operation, and carries in addition about 300 tons of fresh water. There is tankage for 400 gallons of lubricating oil. For a tug, her accommodation is unusual, as she will accommodate as many as 14 men if necessary. Her 200 b.h.p. Fairbanks-Morse oil-engine drives a 50 in. diameter by 58 in. pitch, three-bladed bronze propeller at 250 r.p.m. The hull is built of iron. On November 27th last Capt. Shaw wrote a letter to the engine builders stating that this tug had just completed 13 months' steady operation without a single stop for engine repairs of any kind, during which period she has operated from Jacksonville, Fla., to Eastport, Me.

Capt. Shaw owns two other Fairbanks-Morse oil-engined tugs, one of which is the LORRAINE D., a twin-screw boat propelled by two Fairbanks-Morse oil-engines of 100 b.h.p. each. This boat also is used on the coast and inside route and is now on a regular run between Philadelphia and Boston, towing two 1,000 ton barges. Her oil-engine machinery was installed in 1920. She is a bigger boat than the L. B. SHAW, being 100 ft. overall, 21 ft. breadth and 11 ft. draft, but can be tipped to about 7 ft. draft. Her fuel supply is sufficient for 30 days' operation, while the lubricating oil tank carries 600 gallons. There also is a 60 ton storage of fresh water. The hull is constructed of steel and each engine drives a 50 in. diameter by 30 in. pitch three-bladed bronze propeller, at 340 r.p.m.

JESS B. SHAW, is the name of Capt. Shaw's third tug, which is of wooden construction, 64 ft. long by 17 ft. 6 in. breadth and 6 ft. depth. Originally she was equipped with a 60 b.h.p. Fairbanks-Morse oil-engine, but as her owner desired to use her on heavier work, he installed a 100 b.h.p. engine of the same make. Capt. Shaw states that he is very well pleased with the Fairbanks-Morse oil-engines, which he has used for the last five or six years. All three of these tugs have a very good record with some interesting trips. All of them use low grade fuel, which reduces the operating expenses considerably.



"Lorraine D," a Philadelphian 100 ft. tug equipped with twin Fairbanks-Morse oil-engines

A Veteran Motor Tanker

OSSAGE, ex-FERROL, a motor tanker of 1,020 gross tons, built for the British Admiralty in 1914 at the Fairfield shipyard, Govan, Scotland, and engined with a Fairfield-Carels, eight-cylinder 12" by 20" two-cycle Diesel engine, is now being overhauled at Manchester. She is now owned by Standard Oil interests, having been acquired by the Anglo-American Oil Company.

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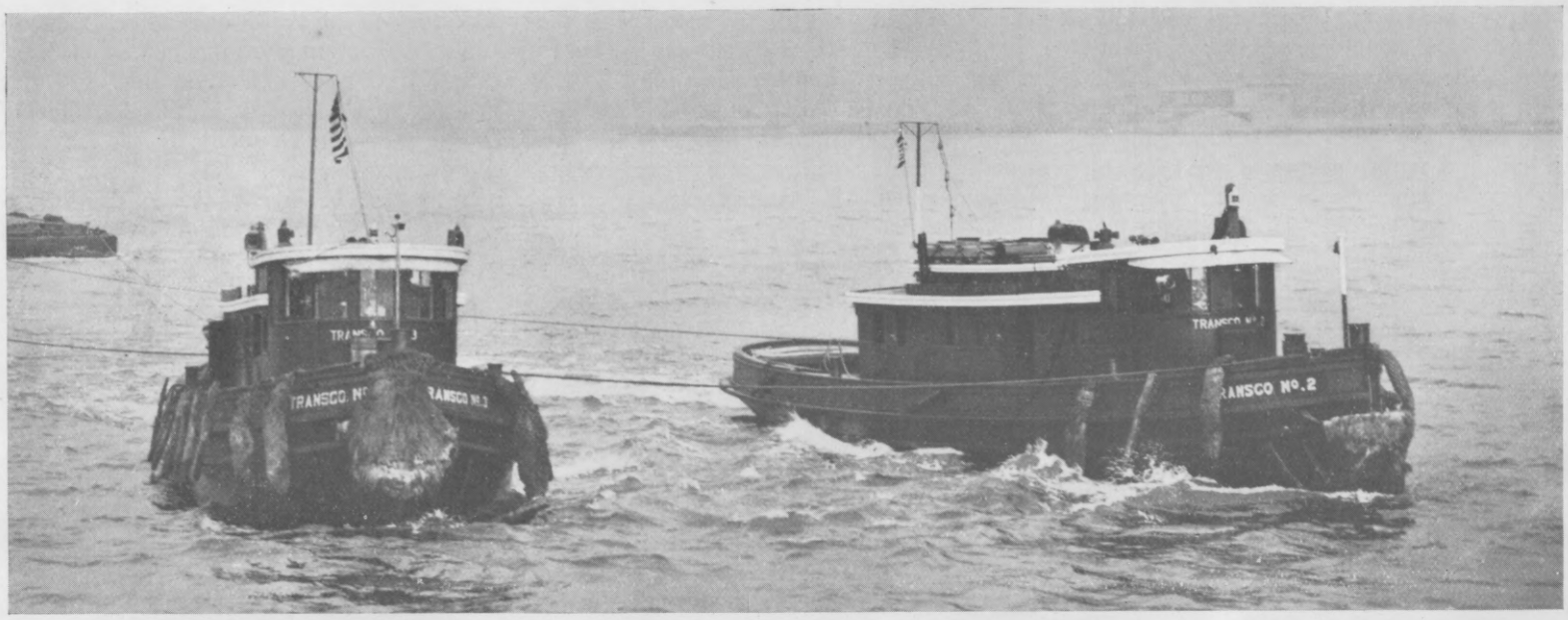

Not a neck and neck race, but the motor-tugs "Transco II" and "Transco III" towing the 12 grain-laden barges illustrated below.

Diesel Tugs Haul Largest Grain Consignment

New York Tow-Boat Owners Should Study the Work of These Boats

Excellent towing work continues to be accomplished by the Nelseco-powered Diesel tugs TRANSCO 2 and TRANSCO 3 which we described and illustrated in our December issue. On November 21st they arrived at New York towing what is believed to have been the largest shipment of wheat ever carried down the Hudson in a single consignment. This shipment was transported from Buffalo via the New York State Barge Canal in four five-unit fleets of the Transmarine Line's Canal barges. Upon arrival at New York a huge banner was spread across the leading barges, carrying the following legend—"Half a Million Bushels of Wheat for Hecker's New York Mill."

Upon arrival of the fleets at Waterford, (the Eastern terminus of the Barge Canal proper) the boats were assembled into one large fleet, four abreast, and towed from this point to New York by the Transmarine Line tugs TRANSCO 2 and TRANSCO 3. Our illustrations show them coming down the Hudson. Had this grain been carried by rail, it would have been necessary to use ten full freight-train loads, or a total of 450 cars. The wheat will be milled into approximately 70,000 barrels of flour—enough to make 27,000,000 16-oz. loaves of bread, or about 200,000,000 "flap jacks." The value of the cargo was estimated at $450,000 at the current market price. A motion picture was made of the fleet, en route, and will be used in the educational film entitled "Wheat and its use," now under preparation. This wheat came from Minnesota and Canadian fields and is transported in Lake steamers from Port Arthur, Fort William, Chicago and Duluth to Buffalo, N. Y.

The TRANSCO 2 and TRANSCO 3 are both equipped with 250 h.p. Nelseco Diesel engines. During the past season they have towed between Albany and New York, working practically 24 hours per day, seven days per week. Their records are 100 per cent. Recently they towed a large cargo of coffee, consisting of 30,000 bags.

Bound Volumes of MOTORSHIP for 1923 — Order Now!

Only a limited number of bound volumes of Motorship for 1923 will be available. Looking back through the twelve issues and the Supplement, we have come to the conclusion, with due modesty, that we have never produced thirteen more useful and interesting issues, so we feel quite proud of our last year's work. We anticipate a repetition of former years' demand, and that all these volumes will be disposed of in a very short time. So order your copy now, and state if desired with or without advertisements and covers. The price per volume will be, bound in half morocco, $8.50, or $8.00 bound in cloth, postage extra according to weight. When ordering your volume *be sure to state what type of binding you desire.* If ordered at once delivery will be made in about three weeks. The volumes will contain a handy index.

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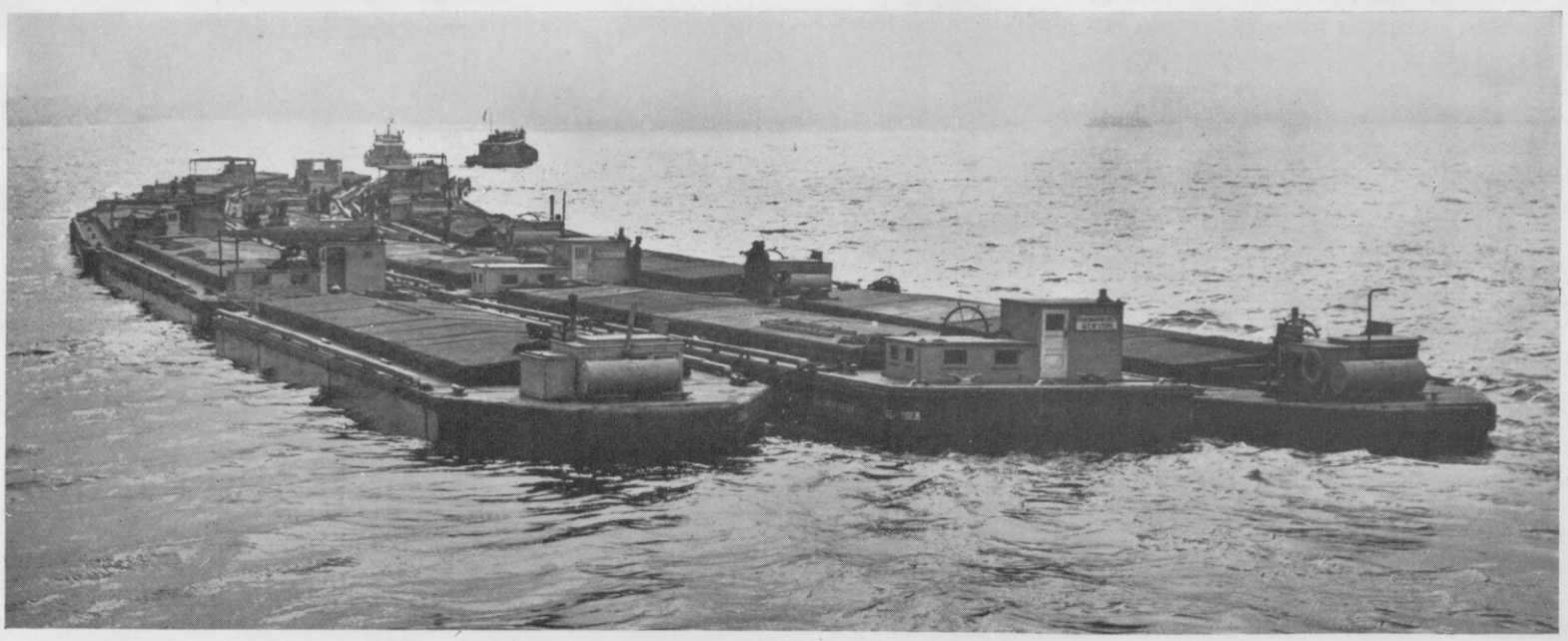

A big haul down the mighty Hudson. The Nelson-Diesel-engined tugs "Transco II" and "Transco III" towing a record load of grain.

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Steamer Munnatawket Now Has Diesel Power

That the steamship MUNNATAWKET—owned by the Fisher's Island Navigation Co. and in service between New London, Conn., and Fisher's Island—would have her steam engine removed and replaced by oil-engine power, was recorded in our issue of October last. The work has now been completed and the MUNNATAWKET is operating daily in freight and passenger service over the same route. Her dimensions are as follows:

Length overall	117 ft. 0 in.
Beam	22 ft. 4 in.
Depth	8 ft. 5 in.
Gross tonnage	204 tons
Net tonnage	102 tons
Power	240 shaft h.p.
Speed	10½ knots

Her 300 i.h.p. compound steam-engine has been replaced with an eight-cylinder Nelseco Diesel-engine of the four-cycle type, developing 240 shaft h.p. at 350 r.p.m., giving her a speed of 10½ knots, which is a shade faster than formerly.

The most important results of the conversion are her present fuel costs, which to the owners are astonishing. Her run is comparatively short and considerable time is spent loading and discharging cargo at the terminals. With her former steam equipment there were longer periods of standby expenses, resulting in heavy fuel cost. Coal charges averaged approximately $20 per day. Standby expenses have now been entirely eliminated through the installation of her Diesel engine and the vessel does exactly the same work on a fuel-oil bill of 90 cents. Furthermore, the firemen are eliminated, as are the periodic boiler cleans and inspections. Another important gain, due to the conversion and removal of the boiler, which was located amidships, is that approximately 30 per cent additional freight-carrying space is available on the main deck. Automobiles are frequently carried during the summer season, so this extra room will permit carrying at least two cars more than formerly. Hence, the MUNNATAWKET will now be able to produce profits to an extent hitherto unconsidered.

In addition to her main Diesel engine there is a 5 k.w. Venn-Severin single-cylinder oil-engine connected to an electric generator and to a small auxiliary air-compressor, furnishing electric current for the emergency motor-driven fire, bilge and sanitary pumps, and for supplying air for charging the air-starting bottles in case the main storage is lost. Two fuel-oil tanks have been installed with a total capacity of 3,000 gallons.

Valvoline Oil Co. Have Motor Tug

Now engaged in delivering kerosene to the supply stations of the Valvoline Oil Co. of New York, in the harbor and on Long Island Sound as far East as Bridgeport, Conn., is the motor-tug MAGNET. This little vessel is equipped with a six-cylinder, direct-reversible, Nelseco Diesel engine of 180 shaft h.p. at a speed of 10 knots. She is a 69 gross tonner, of 82 ft. 3 in. length, by 18 ft. 2 in. breadth and 8 ft. 1 in. depth. In addition to towing barges, about 10,000 gallons of kerosene cargo can be carried on board, together with 1,000 gallons of fuel-oil for the main engine, the latter being sufficient for 100 hours' operation.

Pacific Diesel Plant Expansion

Plans for expansion and entering into the manufacture of small oil-engines for trucks and tractors, in addition to adding to the present equipment for constructing large Werkspoor type Diesel engines, have been announced by the Pacific Diesel Engine Co., of Oakland, Calif., which is capitalized at $2,000,000, half of which is outstanding, and the other half now being placed on the market.

According to the company, the small stationary engine has been given highly satisfactory tests by the Long Bell Lumber Co., Long View, Wash., and the Southern-Pacific Company. Several engines have been placed on exhibition at the company's showrooms, 621 Market St., San Francisco. This is the first showing of its kind ever held in San Francisco.

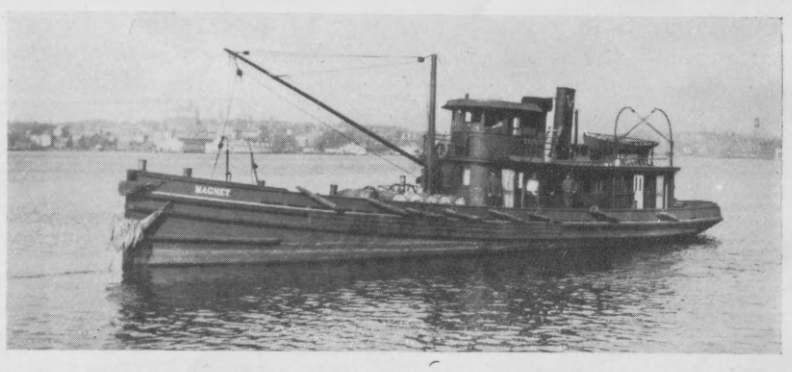
Orders now on hand and upon which work is being carried out, include the following:

Owners	*Number of Engines*	*Power per Engine*
Port of Portland, Ore.	1	200
U. S. War Department	1	110
Sun Shipbldg. Co.	10	70
John Jacobson	1	110
Crowley Launch Co.	1	200
New York Shipbldg. Corp.	6	70
Landa Milling Co.	6	70
Standard Oil Co. of Calif.	1	150

The orders from the Sun Company and New York Ship Building Corporation are for Standard Oil Co. of N. Y. vessels.

In addition to these engines, eleven larger Pacific-Werkspoor Diesel sets have been sold to the Standard Oil Co., of Calif. Orders on hand now amount to $250,000. The plant and equipment are valued at $1,600,000.

Converting this vessel from steam to Nelseco-Diesel power produced unanticipated profits for her owners



This Nelseco-Diesel-powered boat goes about her business in an efficient manner for the Valvoline Co.

Development of Oil Engines Need for Support by Oil Companies

By Henry L. Doherty

"Sooner or later the internal-combustion engine must dominate in the production of power from fuel. . . . High efficiencies with steam plants can only be secured with very large units of 25,000 h.p. and up. The cost of developing power with large units and its transmission and distribution to the ultimate consumer gives the internal-combustion engine a greater advantage because it requires a negligible quantity of water compared with a steam plant and this water does not have to be cold water. It is my opinion that an internal-combustion engine can be built having an efficiency of 50 per cent or better; that it could be so built that its cost would not exceed that of a steam plant of equal size, and that it would be as reliable as a reciprocating steam engine.

"Unfortunately, the internal-combustion engine has received more attention by inventors than by manufacturers, and it is a question in my mind whether any manufacturer, on account of the patent situation, would be warranted in spending any large sum of money for the development of a highly efficient and thoroughly reliable engine of this type unless he is willing to spend a large sum of money each year thereafter to protect himself from infringement. The oil industry could well afford to spend the necessary money for the development of an efficient oil-engine regardless of infringement."

(Extract from paper read before American Petroleum Institute.)

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The Shipping Board's Report and Diesel Power

ONCE again a Chairman of the Shipping Board recommends the adoption of economical Diesel power for American ships, evidently realizing that on such action rests the only possibility of our retaining a successful merchant marine. This is gathered from a perusal of the Seventh Annual Report of the U. S. Shipping Board just presented to Congress by Edward P. Farley, Chairman. Recommendation alone is insufficient. Action,—and immediate action—is imperative. History repeats itself. As we write opposition in the Senate indicates that approval will not be given to Mr. Farley's appointment as Chairman of the Board by the late President Harding. This is regrettable, because Mr. Farley, during the short time he has held the position, has given indications of making one of the best Chairmen the Board has yet had. We refer to this opposition because it reminds us of our Editorial in MOTORSHIP of last June. We then pointed out how very curious it is that on every occasion when the Board has been "going to do something" in the way of motorship construction or conversion, a new Chairman has been appointed and the plans pigeonholed. This has happened right from the days when William Denman, the first Chairman, was asked to resign, when a large motorship contract awaited his signature.

Parts of the Shipping Board's Annual Report for 1923 touch a direct note on the oil-engine industry as well as shipping interests in general. On page 14 appears the following paragraph—"*The measure provided among other things that the Construction Loan Fund, created by section 11 of the Merchants Marine Act of 1920, should be available for reconditioning and re-engineering existing vessels. Under the Act, as it stands, this fund is only available for new construction. With the change recommended it might be possible to secure the improvement and alteration of some of the large passenger vessels now lying idle, but capable of being transformed into efficient craft. It would also thus have been possible to make loans in encouragement of the installation of Diesel engines in existing vessels that have uneconomic stream plants. The existing law only applies to loans for private construction.*" The amendment also provides for the use of the Construction Loan Fund by the Shipping Board itself for reconditioning purposes provided oil-engines are installed.

On page 97 of the Report the Board gives in condensed form the most excellent results of its only Diesel-engined motorship, namely, the WILLIAM PENN. She continued to operate on long voyages during the year, and from an engineering standpoint the wisdom of the installation of her Diesel engines has been conclusively demonstrated. Attention is also drawn to the low cost of stores and repair. Further perusal of the report shows that the Board continued in effect its policy established during the preceding year. This has meant the giving a certain amount of encouragement to private development in America of the Diesel or internal-combustion engine by selling, at hull valuations, ships equipped with defective or uneconomical machinery to responsible buyers who would guarantee to convert such vessels to motorships of approved design. Although what we consider inadequate publicity was accorded to this movement by the Board, and although practically no active conversion propaganda was carried on—except in the pages of MOTORSHIP, this program gained a fair impetus. Ten vessels have been sold on these terms. They include two tankers and range from 2,922 to 11,850 deadweight tons each, and total 64,911 deadweight tons. The Board is of the belief that many ships will be sold for conversion to Diesel propulsion as soon as conversion costs have been reduced; particularly if some form of assistance from the financial standpoint is furnished. We might add,—"provided the Board immediately starts a proper educational advertising campaign." Chairman Farley, in a communication to MOTORSHIP, says that—"*personally I am much interested in this motorship situation, and am in favor of rendering whatever governmental assistance can be rendered to persons contemplating either building motorships or remodeling present ships into motorships.*" Comments by the Board on the turbo-electric drive substantiates what we stated several years ago when the order was given to convert twelve geared-turbine ships to turbo-electric drive. Only five installations have been carried out, although machinery for the remaining seven is on hand. The five electric-driven ships in operation continue to demonstrate the reliability of this class of power. But, in view of the high fuel cost it has been decided by the Board that turbo-electric drive units will not be used for conversion purposes on the program which the Board has under consideration. The Navy Department are figuring on using two sets, while the other five will be disposed of at the best price obtainable. The estimated cost for the installation of the electric-drive in place of the reduction gears has been about $100,000 per ship. Had Diesel-electric power been installed instead of turbo-electric, the desired operating economy would have been obtained. On page 98 of the report is given a list of the ten steamers purchased by shipowners from the Board,

68TH CONGRESS, 1ST SESSION. **H. J. RES. 41**

IN THE HOUSE OF REPRESENTATIVES.

DECEMBER 5, 1923.

Mr. EDMONDS introduced the following joint resolution; which was referred to the Committee on the Merchant Marine and Fisheries and ordered to be printed.

JOINT RESOLUTION

Permitting the use of certain funds by the United States Shipping Board.

Resolved by the Senate and House of Representatives of the United States of America in Congress assembled, That the United States Shipping Board may, in its discretion, use the construction fund as provided in section 11 of the Merchant Marine Act of 1920 for the purpose of converting the present owned ships of the United States into motor ships.

TO SAVE OUR MERCHANT MARINE

Reproduction of the Senate and House Joint Resolution introduced on Dec. 5th, by Congressman Geo. W. Edmonds, with the object of empowering the use of the $125,000,000 Loan Fund for conversion of existing U. S. steamers to economical Diesel power.

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and converted to Diesel power, the make of engine as well as the power being included. As will be seen by our reproduction on Page 18 of Joint Resolution No. 41, which Congressman Edmonds introduced on December 5th, the Board may soon be enabled to use the Construction Loan Fund for conversion purposes. This was not provided for in Section 11 of the Merchant Marine Act of 1920, although the Board evidently is empowered to use other funds for reconditioning ships. If this Resolution is approved by Congress, the Board can use the Loan Fund both for carrying out conversions and for loaning it on easy terms to shipowners for the same purpose, as well as for new private motorship construction. Congressman William S. Greene, Chairman of the Committee on Merchant Marine, advises us that — "the Edmonds' Resolution will probably be called for Committee action very shortly after the New Year, and at present there is nothing to hamper its favorable consideration and report." Mr. Greene states that he is *"heartily in favor of legislation authorizing or directing the Shipping Board to use the Construction Loan Fund for the purpose of converting the present owned vessels of the United States into motorships, because it will mean the conversion of ships which are not now built to compete in the world's markets into vessels that will do justice to the American flag, under whose emblem they are operated. It will mean that the American Merchant Marine will more successfully compete with the ships of other nations which is, after all, our primary aim."*

Senator Wesley L. Jones, chairman of the Committee of Commerce, tells us that he is heartily in favor of action along the lines of the Edmonds' Resolution, slightly modified to show that it is simply an additional use to which the money can be put.

It is not without interest we note a subtle suggestion in the report that the Board are thinking of converting one or two ex-German passenger liners to oil-engine power. Altogether the Loan Fund authorized by Congress totals $125,000,000, of which the Board actually has $50,000,000 in cash on hand. As regards new buildings by private shipowners, loans up to the present time have only been made for two Diesel-electric driven vessels. Apparently this is owing to lack of *bona fide* requests. Meanwhile, other nations have realized the importance of the competitive results of motorizing the American mercantile marine. They are taking advance steps to counteract some of its probable effects. Elsewhere in this issue is shown that the British Government has granted $8,000,000 for the construction of 19 motorships for one shipowning company. It has also advanced $10,000,000 for the construction of two huge Diesel-driven liners. Sweden, Italy and France, too, have given grants for aiding motorship construction. This is not all! We give on the same pages a list of the most important of the motorships building in Europe, of between 5,400 and 20,000 i. h. p. and of 8,500 to 20,000 gross tons each. These fully indicate the determination of shipowners abroad and their governments to maintain supremacy. Our steam-driven passenger liner GEORGE WASHINGTON burns 330 tons of coal per day at 17.2 knots. The Union Castle Line's new Diesel-driven liner will burn only 65 to 70 tons of oil daily at 18 knots. Both are about the same size. Just realize what the difference means!

Just how dominating is the importance of the motorship question to both Great Britain and this country? This is answered by a column-length Editorial in the November 24th London *Daily Telegraph.* "The oil-engined motorship is threatening our coal-mining industry and eliminating a 21,000,000 tons foreign bunker trade"—says the Editor, who urges the extraction of oil from coal. We cannot reproduce the Editorial in its entirety, but give the following significant extract:—

"The triumph of the motorship, when it is complete, will have some remarkable results. In the first place, it will cheapen ocean transport of passengers and goods, and humanity generally will profiit. In the second place, it will further handicap the airship, which is already at a sufficiently serious disadvantage. The motorship and her load is borne by the sea, and her engines have merely to supply movement; the airship has not merely to supply movement, but to support her own weight as well as that of her cargo. In the third place, coal will more and more go out of use by sea. That is a serious matter for us who in normal times have supplied bunkers to vessels in the foreign trade amounting to 21,000,000 tons a year. It is also inevitable that the increasing use of oil abroad for rail transport, as well as for factory power, will limit our coal exports, now reaching to about 70,000,000 tons a year, Indeed, the triumph of oil over coal may be very bad for this nation, its shipowners, and its miners unless scientific vision finds expression in action. On the present basis, the coal-mining industry is threatened. We are at the birth of a new age; but if courage and enterprise be exhibited there is no reason why our coal measures, converted into oil and other by-products, should not continue to be one of our main sources of wealth and the support of a supreme sea-carrying trade. That is no more a dream of the visionary than is the motorship, at which sceptics scoffed only a few years ago."

In the face of this serious and complex situation economic laws cannot be ignored. Small wonder then the out-spoken remarks of a few weeks ago of J. Herbert Scrutton, chairman of Lloyds' Register of Shipping at a dinner attended by many of the most important British Government, and shipping and engineering officials. He urged development and adoption of the marine Diesel-engine on the grounds that cheap transport is most important in carrying on civilization, and that the Diesel engine gives the greatest opportunity for World trade. *"The marine engineer,"* he said, *"must force its development until it becomes universal."*

As coal goes out as a factor on the high seas, oil comes in, and with it America's opportunity. Our coal exports are nearly all to Canada, and but little over the oceans. World-wide adoption of oil-engine power will increase the already big foreign lubricating and fuel oils business of our oil companies. It is not surprising that Henry L. Doherty on page 17 pleads for more direct and whole-hearted encouragement of the development of the oil-engine by American oil companies. Adequate concerted action on the part of American shipowners, oil companies and the Shipping Board during the coming twelve months is vitally necessary. It forms our last opportunity for preparation for the maintenance of a proper merchant marine needed to sustain our overseas markets. The economical oil-engine is absolutely essential. Unless much is done during 1924 we can give up all hope of a large commercial navy, and fly our ensign at half-mast. We may even have no mast to fly the ensign from. We cannot otherwise compete on the Seven Seas, and will be left to operate solely coastwise and inland routes. This is inevitable.

What the Board Already Can Do

"THE use of the Construction Loan Fund for Diesel installations is not likely to lead to the marketing of many of the Shipping Board's idle vessels"— says THE NAUTICAL GAZETTE in its Editorial for Dec. 2nd last. *"We doubt,"* remarks the Editor, *"whether Congress can be prevailed upon to grant any such enlarged powers upon the Board by amending the Jones law to permit it to apply the Fund either to re-engining or re-conditioning its existing vessels, or to the building of desirable types."* We draw our esteemed contemporary's attention to the fact that the Board is already empowered to re-condition or instal new machinery in existing vessels where needed and does do so. It uses for this purpose money which otherwise could be diverted to the Loan Fund.

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Steamers Versus Motorships

Some Interesting Extracts From a Paper on Use of Fuel-oil for Ship Propulsion Read Before the American Petroleum Institute Convention at St. Louis, Mo., December 12th

By Joseph E. Sheedy,
Vice-President, Emergency Fleet Corp.

MODIFICATION of equipment calls for study of each individual vessel. This breaking up of the problem into unit study means that the problem in one case may involve a very considerable amount of fuel, such as in the case of the S. S. "Leviathan," which burns about 6,000 barrels per day, and a much less amount in another case, such as a typical cargo boat built by the American International Shipbuilding Corporation which will burn about 190 barrels per day.

Results from tests carried on at the Navy Fuel Oil Test Plant and from tests made by the United States Shipping Board show that it is entirely feasible to obtain with oil-fired boilers efficiencies from eighty to eighty-five per cent. In practice, however, our investigations show that the efficiency obtained in average practice is seventy per cent or less. However, in a number of cases where the fuel problem has been thoroughly attacked, the vessels show approximately eighty per cent boiler efficiency.

Comparison of the two forms of combustion used on shipboard, namely, the oil-fired steam plant and Diesel engine as applied to ship propulsion, means the comparison of a well-established practice with a practice recent in its development but which has all the indications of becoming, in the not distant future, the accepted type, particularly for cargo vessels and long voyages.

The first part of this statement is shown by the relative number of ships using the two methods. In the case of the United States Shipping Board's active fleet of 412 vessels, one is driven by Diesel engines, while the 411 others are steam-driven, and of this 411 eighty-five per cent are oil burners, which gives a ratio of one Diesel drive to 350 oil-fired steam-driven vessels.

The second part of the statement is borne out by the continued successful operation of such Diesel installation as have been made and the interest shown by the engineering world, especially the various shipyards, in developing a satisfactory Diesel engine which may be built at a reasonable cost so that the advantages of the Diesel drive will not be offset by the present difference in the first cost of the installation.

Steam engineers realize that if the Diesel engine with its thermal efficiency of approximately thirty-one per cent, as compared with the thermal efficiency of the steam plant of approximately fourteen per cent, can be installed at approximately the same cost as the steam plant; and if the steam plant is to be a successful competitor to the Diesel engine, it is imperative that the thermal efficiency of the steam plant be improved, and with this end in view development work is being carried out, results of which predict steam plants using 1,500-lb. per square inch steam pressure with 800° temperature.

Personally, I believe, however, that the high pressure steam plant in the marine field will be confined to Navy installations and there is little possibility of its being accepted for the use of the merchant marine.

Development work on the part of the steam engineers will probably have but very little effect on the adoption of the Diesel drive for future installations but it certainly will make more imperative the necessity of reduction of the first cost, which is now about two to one in favor of the steam plant. This reduction in cost can only be brought about by standardization of equipment and quantity production methods.

Another prime factor which affects the relative value of the Diesel to the oil-fired steam plant for marine use is the weight. On short voyages there is no benefit to be gained by the Diesel installation and, in fact, comparisons made between existing steam and several Diesel installations show a differential of approximately five per cent in favor of the steam plant in some cases, but on long voyages to the Far East or to South America, when the extra feed water and bunker fuel is taken into account, the weight differential is approximately five per cent in favor of the Diesel drive.

The Diesel plant in the present state of development functions much more satisfactorily when using oil of 20° Beaumé or better, and in practically all cases where an inferior grade of oil has been used operating difficulties and maintenance charges have more than offset the cost differential between the two grades of oil.

The oil-fired steam plant, however, can and does use oil of ten degrees Beaumé satisfactorily, providing means are supplied to heat the oil to a temperature where its viscosity will permit it to be pumped, which for transfer purposes is about 200° Engler and also that it can be further heated so as to produce a viscosity of from 2° to 4° Engler just before it reaches the burner. Experimentation has shown that the mechanical atomization depends chiefly on the viscosity and not on the gravity of the oil.

[Here followed the comparison between the Motorship William Penn and the steamer Ethan Allen published in our November issue, to which our readers can refer.—Editor.]

The steamship carries twelve men and her payroll is $1,287.00 per month, while the motorship carries fourteen men with a payroll of $1,632.50, making an increase of $4,146.00 per annum in wages for the Diesel ship, while the extra expense in feeding the two additional men would be $346.50, making a total extra expense for the crew of $4,492.50. This difference, in part, is brought about by the fact that the William Penn, which is the only Shipping Board Diesel-driven vessel, is in the nature of a test vessel, and judging by a merchant standard, is probably slightly overmanned, while the Ethan Allen has a minimum crew.

The total fuel consumption of the William Penn was 9,752 barrels, while for the Ethan Allen it was 30,760 barrels, making a ratio of 3.15 in favor of the Diesel drive.

The bunker capacity of the two vessels is such that the motorship can take on fuel at ports where it is the cheapest, while the steamship is not always able to do this. With this in view, the average price of fuel on the voyage would be about $1.70 per barrel for the Diesel-engine vessel and $1.50 for the steam-driven vessel. The saving of fuel in favor of the motorship is $57,120.00, which is offset to some extent by the increased wages and food for the crew and the cost of the lubricating oil, which would leave a net saving of $51,235.00, excluding interest on the investment, insurance, depreciation and maintenance in favor of the Diesel ship, the first two items about counteract the last two.

In view of this operating cost, I have recommended to Admiral Benson that for several vessels of about the same tonnage as the William Penn now fitted with turbine drive and reduction gears, which will be in need of gear replacement and for which turbine electric drives have been purchased, the proposed change to this turbine-electric drive be abandoned and Diesel drive installed. Admiral Benson has seen for some time the necessity of this development by the American engineers, in order that we may successfully meet the competitive service of the Merchant Marine of other nations.

The Diesel-driven vessel is especially well adapted to the Far East, the South American, the West Coast of Africa, the Cape of Good Hope and around-the-world services, all of which are being operated by the United States Shipping Board. These are all trade routes which offer the opportunities for a successful merchant marine and the competition in these routes will be most intense and in order that we meet our competitors on at least an equal footing, it is imperative that we have the most economically-driven ships that it is possible to have. Otherwise, with the increased costs due to American standards of living and imposed by our laws, it will be impossible for American flag vessels to profitably operate in competition with foreign vessels.

That the advantages as shown by his investigation may be realized, Admiral Benson at present is advocating legislation which will modify the present existent Construction Loan Fund laws so that a large part of this fund shall be available for Diesel-drive installations in the vessels of the American merchant marine.

There is a considerable amount of detailed information regarding both the oil-fired steam-driven vessels and the Diesel-driven vessels, which has been compiled by the Fuel Conservation Committee, giving the performance of these vessels. This information is available and will be gladly furnished to any of the members who will write for it.

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Lenz Hydraulic Transmission System

A New Type of Combined Reduction and Reversing Gear for Application to Marine Work

In view of the many attempts now being made to adapt small high speed engines for marine propelling plant, in place of those of the slow speed, direct coupled, reversible type, much interest is attached to a hydraulic device recently developed for this purpose by the well known Austrian firm, the Grazer Wagen und Maschinen Fabrik.

Up to the present time in this country the electrical transmission system has found the greatest favor, but the system here described has indubitable advantages in reliability, cheapness and simplicity.

Several systems of hydraulic transmission are already in use for various purposes, such as the Foettinger transformer for ship work and the Williams-Janney gear for steering gears and winches, but the Lenz transmitter, as the new device is called, differs from these previous designs in using a wing or vane pump and a similar type of motor.

A complete installation is at present being fitted in a side-wheel tug, the transmitter in this case being inverted so that the driven or motor shaft is over the pump and engine shaft. This entails alteration in a few minor details of design only, and the trial results may be awaited with the greatest interest.

The arrangement of the transmitter will be evident from the accompanying drawings. It will be seen that the device consists of a pump and motor incorporated in the one casing and having their shafts at right angles, whereby it is possible to obtain a shorter and smoother path for the operating oil and consequently a higher efficiency.

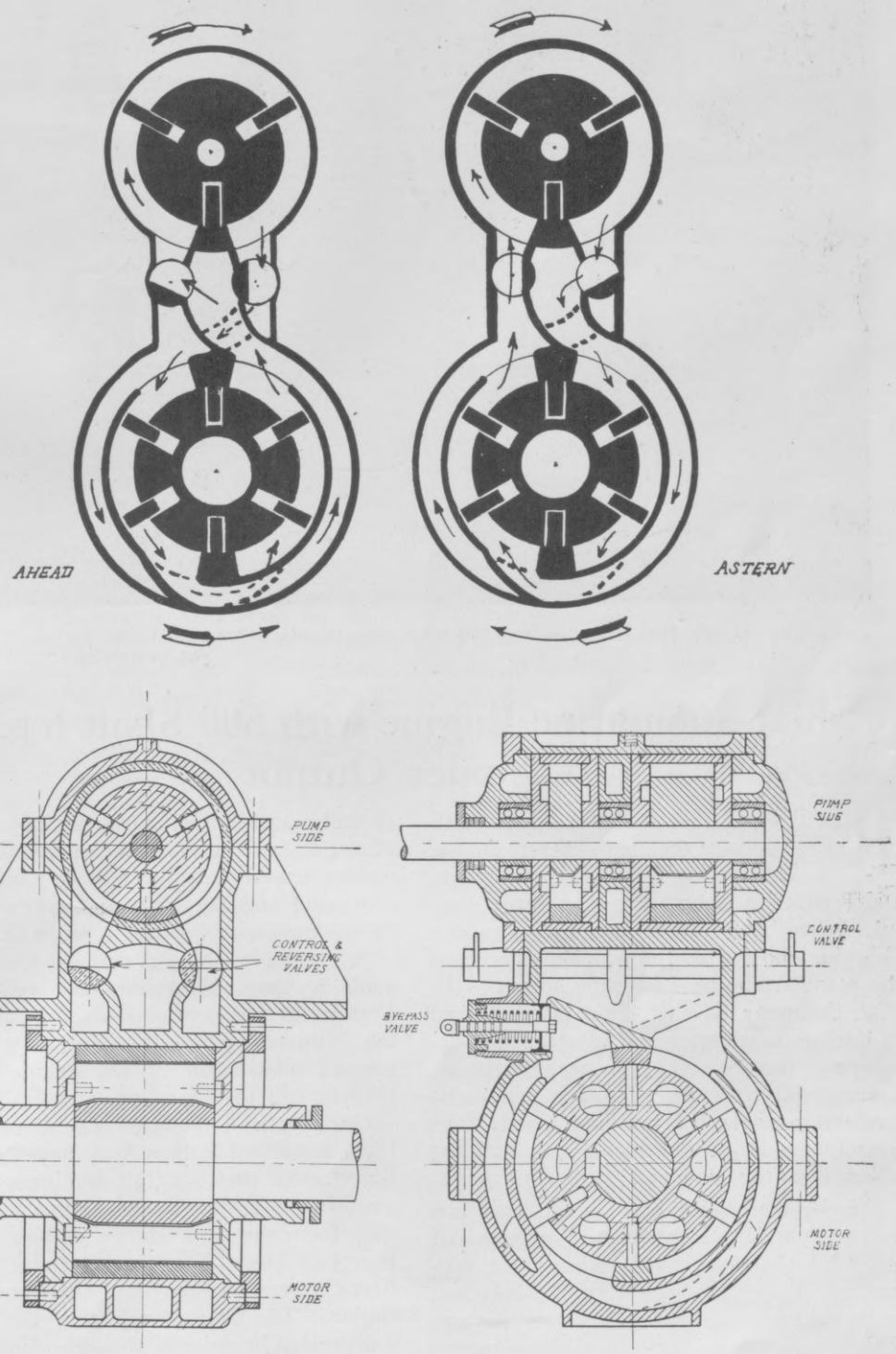
The vanes of the pump and motor are free to move radially in their respective rotors, and are constrained to move in their correct paths during rotation by rollers attached to their ends and working in grooves cut in the end casings.

In order to provide a wide range of propeller speed with constant engine speed, the pump is divided into two sections, one section having twice the width of the other, and by a suitable arrangement of control valves either section separately or both together may be used. This gives three particular shaft speeds for one particular engine speed, and intermediate shaft speeds can be obtained at the same engine speed by by passing a portion of the oil from the discharge side of the pump to the suction side.

Reversing is effected by the action of the control valves which, when suitably set, reverse the flow of oil to the motor, the action being readily followed from the diagram.

Relief valves are fitted wherever an accumulation of pressure is likely to occur, and arrangements are made for passing some of the oil through a cooler as a certain amount of heat is developed by friction and churning.

The compactness and simplicity of this transmitter when compared with a similar electrical system is readily apparent, and trials of an experimental unit have shown very favorable efficiencies.



6,200 Horsepower Motor Meat-Carrier

LOCHMONAR, the new Harland & Wolff-built twin-screw motorship referred to elsewhere briefly as having been launched on December 8th, is intended for the meat-carrying trade between Great Britain and the west coast of North America via the Panama Canal. She is a fast vessel and will average about 13 knots when loaded. Her gross tonnage is 9,500 and she is propelled by twin Harland-B. & W. Diesel engines each developing 3,200 i.h.p. at 115 r.p.m. Each main engine has eight cylinders 740 mm. (29.13 in.) bore by 1,150 mm. (45.27 in.) stroke.

There are in addition four 150 Diesel engines at 300 r.p.m., each driving a 100 k.w. electric generator. This provides all the auxiliary power which includes 22 derricks, as well as one 25-ton derrick operated by six 3 ton electric winches and ten 7-ton electric winches.

Accommodation is provided for 12 passengers, but the dining-saloon can seat 34 persons. There is also a smoke room. All accommodations are heated by electricity, and electrically-heated boilers are fitted where necessary. The LOCHMONAR is 485 ft. long by 60 ft. breadth and 39 ft. 6 in. depth.

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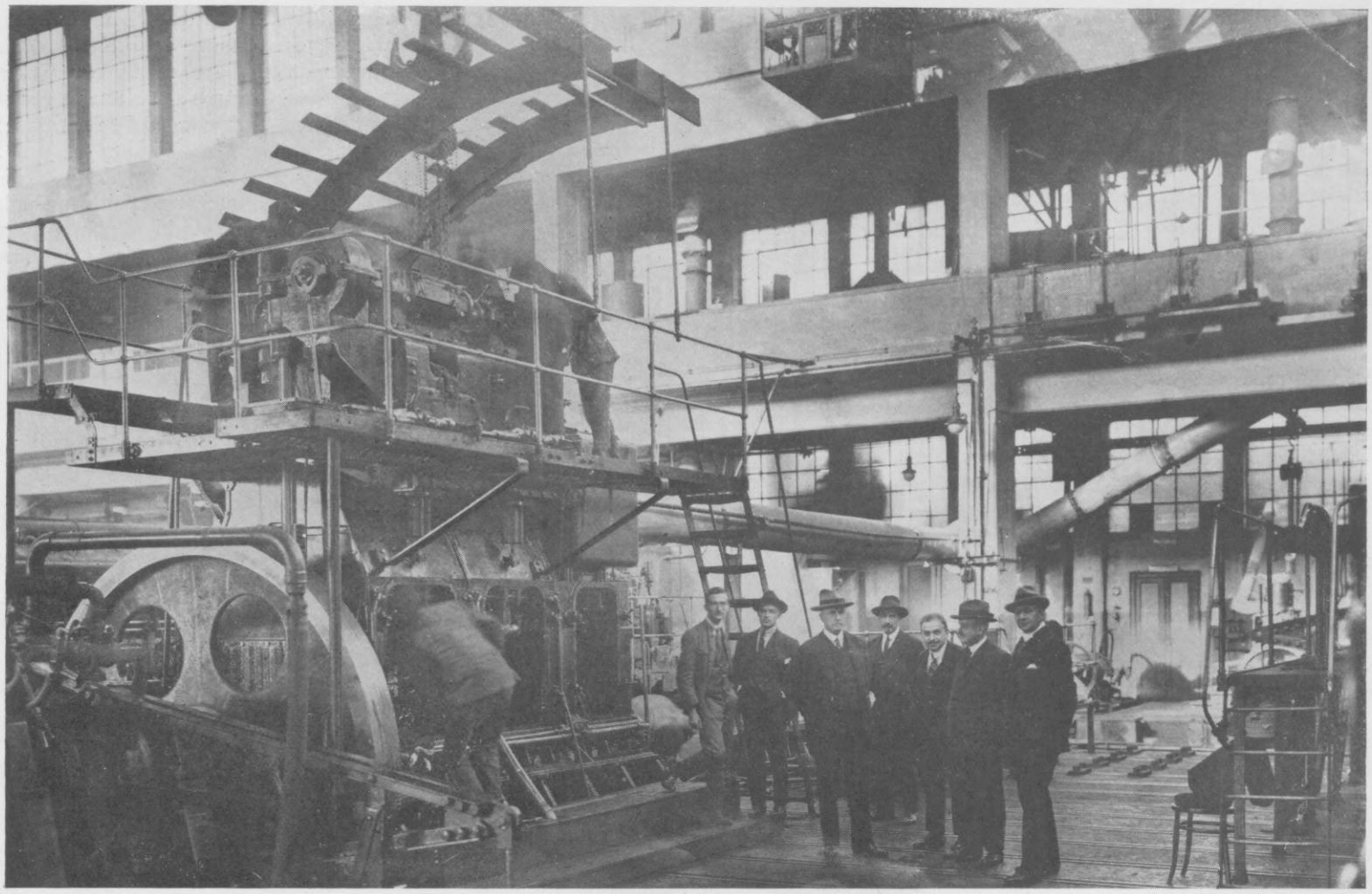

Examining the new Fiat two-cylinder 1,000 b.h.p. experimental submarine Diesel engine. The cylinder output of 500 b.h.p. is the largest for this type yet completed

Fiat Submarine Engine with 500 Shaft h.p. Cylinder Output

RECENTLY we had the opportunity of visiting the big Diesel engine works of the Fiat Co., of Turin, Italy, which a short time previously they had taken over from the Ansaldo-San-Giorgio, who during the war had purchased the plant from the Fiat-San-Giorgio — the Fiat Company at that time being forced to devote its energies and intentions to developing motors, etc., for war purposes. Commercial activities of peace conditions made it possible for the Fiat Co. to take over the work of developing and building oil-engines for land and marine purposes.

Among the engines seen on our visit was a two-cylinder, experimental engine of 1,000 b.h.p., studied and designed for propulsion of the new cruiser type submarines to be built later for the Royal Italian Navy. This is a two-cycle engine, having an output of 500 b.h.p. per cylinder, which is of higher power than has yet been obtained from any other submarine engine cylinders and means that 4,000 shaft h.p. can be obtained from an eight-cylinder unit. A practical demonstration of the reliability and efficiency of this new design of Fiat Diesel engine was given by a non-stop run of 12 days in the presence of the officials of the Royal Italian Navy, four days being at full load and eight days being at nine-tenths her rated load, with short periods of overload. The total run was equivalent to a 5,000 miles sea trip at full speed, which surpasses any period of continued running anticipated in submarine operation. Results were most encouraging and the Fiat Company received the warmest compliments from the delegates.

While the engine was running a visit was made by Sig. Mussolini, the well-known Premier of Italy, who was accompanied by the Minister of the Navy, and who expressed admiration of the engine to the Directors of the Fiat Company.

Our illustration shows the Commission from the Royal Italian Navy, together with Directors of the Fiat Co. examining the engine, following the 12 days' run. The fifth man from the right shown without hat, is Ing. G. Chiesa, Technical Director of the Fiat Co., responsible for the design of the engine. The frame-work over the engine was erected in order to show the dimensions and internal shape of the engine-room of a submarine of the size in which the complete engine will be installed, and indicates the small space available for erecting and overhauling the engine in service.

Another Diesel-Electric Yacht

Reference was made in our last issue to the conversion of the auxiliary steam schooner yacht CUTTY SARK, owned by Alexander Smith, of New York. Her steam plant has been removed — and in its place is being installed a Winton-Westinghouse Diesel-electric propelling system at one of the New York dry dock and repair plants.

CUTTY SARK was formerly the ARIADNE and is 131 ft. long, by 26 ft. breadth and 15 ft. 3 in. draft. She is of 246 gross tons, or 168 net tons. Her new propelling equipment consists of two 100 b.h.p. Winton Diesel engines, each driving a Westinghouse generator that provides current for a single 150 b.h.p. Westinghouse electric motor. Engine-room controls will be carried direct to the pilot house where the navigator will have direct control over the propeller. It may be recalled that this method of control, known as the Ward-Leonard system, recently enabled the skipper of the 190 ft. yacht GUINEVERE to bring her from full speed ahead to a dead stop in less than 15 seconds, and from full speed ahead to full speed astern in less than 25 seconds. Incidentally, the GUINEVERE has electric motors for hoisting her auxiliary sails. All sorts of electrical equipment for the guests and crew will be installed in the CUTTY SARK. Her reconditioning is in charge of C. D. Mallory & Co., and Tams & King.

Sulzer Diesel-Engined Vessels.

We have received from Sulzer Freres, of Winterthur, Switzerland, a complete list of naval, merchant vessels and yachts fitted with Sulzer Diesel engines, eliminating submarines. This list contains a total of 112 ships, the engines of which aggregate 216 engines of 145,500 total h.p. Some of these vessels are still under construction and are due for early delivery.

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From Gasoline to Oil Engine Power

Conversion of Standard Oil Barge No. 7

Although the Winton gasolene engines at present installed in Barge No. 7 owned by the Standard Oil Co. of N. Y. have proven quite satisfactory so far as operation is concerned, it has been found, after investigations, that her owners are warranted in changing her to heavy-oil engine power. This is rather important as we presume that an oil-company can secure fuel at the lowest price.

The present propelling plant has sufficient power to propel the vessel at a service speed of about 8¼ knots when developing 175 shaft h.p. at 402 r.p.m. This machinery is to be replaced by a Winton Diesel engine developing 225 b.h.p. at 250 r.p.m. The new plant is anticipated to increase the speed of the barge to 8½ knots and at the same time reduce the fuel cost by $7,885 per year. These figures are based on the actual present consumption of 19.27 gallons per hour of light fuel and an estimated consumption of 28 gallons per hour of heavy oil for the new Diesel plant. Up to the present year her fuel bill has been in the neighborhood of $11,500. It will be reduced to $3,615.

Considering that the barge is only of 265 long tons deadweight-capacity, the saving is really remarkable and it will not be long before the cost of the conversion will be wiped off. In any event, it is far more than sufficient to pay the interest on the conversion charges. But, at the same time we cannot help thinking of the additional saving that would have been effected had the barge been equipped with oil-engines when she was originally constructed in 1921 by the Baltimore Shipbldg. & Dry Dock Co., of Baltimore, Md.

She is a twin-screw steel, single-deck vessel with her machinery aft, and is arranged for carrying refined petroleum products in bulk under deck. She has the following dimensions —

Displacement	539 long tons.
Deadweight capacity	265 long tons.
Power	225 shaft h.p.
Length	140 ft.
Beam moulded	28 ft.
Depth moulded	8 ft.
Draft, extreme	6 ft.

In addition to the new main engine a Winton auxiliary air-compressor, together with the necessary starting and injection air bottles will be installed, but otherwise the existing auxiliary machinery will be retained.

It is interesting to note that during the first few months of her operation the engines of the barge were run on gasolene. Then a kerosene carbureter was developed by James Winton and installed, and the engine operated a short time on kerosene fuel. But, the results contemplated were not produced, so a special preheating system was fitted which has permitted the successful operation of the engine with kerosene fuel. Yet, in spite of this, considerable economies will be effected, as shown, through the installation of the Diesel engine.

Passenger Boat Grand Rapids

In the early summer of this year a 46 b.h.p. Wolverine oil-engine was installed in the passenger boat GRAND RAPIDS of Pensacola, Fla. She is 56 ft. by 13 ft. by 3 ft. 9 in. and of 14 gross tons. After the boat had been in operation the captain wrote the Wolverine Motor Works, at Bridgeport, stating that her fuel consumption with the engine running at 300 r.p.m. gave him the same speed as he got with the old and higher powered gasolene engine on 110 gallons of gas oil compared with 225 gallons of gasolene used formerly. The gasolene used to cost him 20 cents, whereas he only pays 5½ cents for fuel-oil. Hence, the fuel-bill has been reduced from $45 per week to $6.05 per week.

On October 10th. the captain wrote stating that he has not taken out the spray nozzles for cleaning purposes for three months. The boat operates seven days per week during the summer season and five days per week during the fall.

"Grand Rapids," of Pensacola, powered with a 46 b.h.p. Wolverine oil-engine

Tug Converted From Steam to Oil-Engines

The Carey Davis Tug & Barge Co., of Seattle, has just placed in service another oil-engined tug-boat named DOUGLASS, formerly the U. S. Navy steam mine-layer LIEUT. HAROLD B. DOUGLASS, trials having been run on the 3rd. The trial trip consisted of a circumnavigation of Bainbridge Island, at a speed of 9 knots. She was converted from steam power and equipped with a 320 shaft h.p. Bolinder surface-ignition oil-engine driving an 84 in. diameter propeller at 225 r.p.m. All the electric driven auxiliaries of this tug were constructed and installed by the Markey Machinery Co., of Seattle, under the supervision of Henry Lund, representatives for the Bolinder Company. The Markey Machinery Co. also supplied an auxiliary surface-ignition oil-engine of 20 b.h.p. driving a compressor and generator. Other auxiliary electrical equipment consists of a 3½ k.w. generator supplied by the Marine Electric Shop of Seattle, driven by a belt off the main engine and an exide 220 ampere 115 volt battery.

Many local shipping men were on board, through the invitation of George R. Carey, President of the tug-boat company, which owns a fleet of ten boats, one Diesel powered and four with surface-ignition oil-engines. Five tow-boats are steam-powered, which gives the company ample opportunity to compare the operation of steam versus Diesel. Their opinion is evidently shown by the conversion of the DOUGLASS.

Launch at Kiel-Gaarden, Germany, of the Diesel yacht "Vanadis" owned by C. K. G. Billings, of New York. She is 240 ft. long and propelled by twin 900 shaft h.p. Krupp Diesel engines

Roland, a 250 Shaft H.P. Motor Tug

Among the many oil-engined tugs placed in service this year is the Oakland Launch & Tug Boat Company's tow-boat ROLAND, powered with a 250 shaft h.p. four-cylinder, four-cycle Atlas-Imperial oil-engine. She is one of the most powerful motor-tugs yet placed in service on the Pacific Coast and is an example of a fine engine-room installation. Her owners expressed themselves as being exceedingly pleased with the boat and her equipment. In addition to the regular oil-engine installation, arrangements have been made to enable the pilot to handle both the engine and rudder from the pilot house as well as from a station next to the towing bitt. For this purpose the boat has been equipped with an Atlas double type combination starting gear and engine control. There also is a pneumatic steering gear arranged to be operated from the same points. Air for operating the pneumatic steering gear is taken from the engine-room air tanks.

The Oakland Launch & Tugboat Co.'s motor-tug "Roland" powered with a b.h.p. oil-engine

Motor-Tanker and Three Motor-Tugs For Atlantic Refining Co.

An Ingersoll-Rand oil-engined tanker is being built at Staten Island for the Atlantic Refining Co., in addition to three Diesel-electric tugs, making eight Ingersoll-Rand oil-engines just ordered by this Philadelphian oil concern.

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France's First Big Motorship

Sulzer Diesel-Engined Freighter CAMRANH Runs Trials

FOLLOWING some delay in the construction of her hull, the new 11,700 tons d.w. motorship CAMRANH building for the Chargeurs Réunis, of Paris, was launched on November 10th at the Nantes yard of the Chantiers et Ateliers de la Loire. She is the first French motorship of over 7,500 tons d.w., so is of not a little importance.

Her propelling machinery consists of twin Sulzer four-cylinder, two-cycle, crosshead type reversible marine engines, 680 mm. (26.77 in.) bore by 1,100 mm. (43.30 in.) stroke, each of 1,700 shaft h.p. at 80 r.p.m. on a weight of 192 tons per engine. In the engine-room there also are two 410 b.h.p. Sulzer Diesels driving generators at 200 r.p.m., as well as a 30 b.h.p. Sulzer surface-ignition oil-engine driven generator set. Two electric motors operate a turbo blower running at 2,550 r.p.m. and capable of delivering 5 cubic meters of air at a pressure of 0.115 kg. per sq. cm. (17,650 cu. ft. at 1.6 lb. per sq. in.) Either of these blowers can supply sufficient scavenging air for both the main engines when running at full load.

The auxiliary plant also includes two 26 h.p. Sulzer centrifugal pumps electrically driven for supplying the cooling water to the engines, and an auxiliary Worthington lubricating oil-pump worked by compressed air. The force-feed lubrication is obtained from pumps driven off the main engines themselves. There is also a small emergency compressor driven by a 6 h.p. Sulzer surface-ignition oil-engine.

These engines were built at the Winterthur works in Switzerland, of Sulzer Bros. Tests, as follows, were carried out at the works in the presence of representatives from the Chargeurs Réunis, and from the Bureau Veritas under the survey of which the ship is built.

SUMMARY OF ENGINE TRIALS AT FULL LOAD

	Port engine	Starboard engine
Duration of trial	8½ hours	8½ hours
Engine speed	85.36 r.p.m.	88.25 r.p.m.
Power (mean)	1,710 b.h.p.	1,750 b.h.p.
Power absorbed by motors for blowers and pumps	82.1 b.h.p.	82.1 b.h.p.
Fuel consumption per b.h.p. hour of main engines	0.385 lb.	0.375 lb.
Fuel consumption of auxiliaries per b.h.p. hour of main engines	0.022 lb.	0.024 lb.
Total fuel consumption per b.h.p. hour	0.407 lb.	0.399 lb.
Scavenging-air, mean pressure, per sq. in.	1.5 lbs.	1.5 lbs.
Cooling-water pressure, jackets, per sq. in.	7 lbs.	7 lbs.
Cooling-water pressure, pistons, per sq. in.	30 lbs.	30 lbs.
Low-pressure stage of air compressor per sq. in	20 lbs.	20 lbs.
Intermediate-pressure stage of air-compressor per sq. in.	135 lbs.	130 lbs.
High-pressure stage of air compressor per sq. in	925 lbs.	900 lbs.
Cooling-water temperature at inlet, Fahr.	46 degs.	46 degs.
Cooling-water cylinder outlet, Fahr.	100 degs.	100 degs.
Cooling-water piston outlet, Fahr.	122 degs.	115 degs.
Temperature of exhaust	450 degs.	470 degs.

REDUCED LOAD TESTS

Duration of trials	½ hour	½ hour	½ hour
Load	¾ load	½ load	¼ load
Engine speed, mean.	77.4 r.p.m.	68.1 r.p.m.	53.9 r.p.m.
Power, mean	1,282 b.h.p.	863 b.h.p.	434 b.h.p.
Power absorbed by motors for blower and pumps	63.2 b.h.p.	42.8 b.h.p.	39.05 b.h.p.
Fuel consumption per b.h.p. hour, main engine	0.385 lb.	0.397 lb.	0.450 lb.
Fuel consumption of auxiliaries per b. h.p. hour of main engine	0.026 lb.	0.032 lb.	0.056 lb.
Total fuel consumption per b.h.p. hr.	0.411 lb.	0.429 lb.	0.506 lb.

Lubrication-oil consumption for cylinders and for hand lubrication amounted to less than 0.3 per cent of the fuel consumption or about half-a-gallon per hour for both engines when together developing 3,400 s.h.p. Overload capacity was tested on one of the engines; it developed 2,200 b.h.p. at 91 r.p.m. Slow running tests were also carried out; all cylinders fired regularly at 27 r.p.m.

Regarding general dimensions of the CAMRANH, these are as follow:

Name of ship	Camranh
Loaded displacement	17,097 tons.
Hold capacity	18,400 cu. meters.
Deadweight capacity	11,700 tons.
Net-cargo capacity on long voyage	10,200 tons.
Power at shafts	3,400 b.h.p.
Speed, loaded	12 knots.
Make of main engines	Sulzer.
Weight of two main engines with flywheels and thrusts	384 tons.
Type of ship	Twin-screw spar-deck.
Length, b.p.	452 ft. 1 in.
Breadth, md.	59 ft. 4 in.
Depth, md.	40 ft. 2 in.
Draft, loaded	29 ft. 5 in.
Fuel capacity, double bottoms	1,846 cu. meters.
Capacity of refrigerator room	75 cu. meters.

All deck and engine-room machinery is electric-driven, and there are 13 deck winches of this type for working cargo.

Messageries Maritimes New Motor-Liner

Sulzer Diesel Engines Probably Will Be Installed

IN our October issue, 1923, we gave preliminary details of the 14,000 tons displacement motorship for the Services Contractuels des Messageries Maritimes, of Paris, and in November we reported that the Chantiers de France had received the contract for this vessel, which is of not little importance as she is only the second motorship of over 7,500 tons to be ordered by French shipowners. We also mentioned that the make of the Diesel engine was then undecided. They are to be two engines of 2,250 shaft h.p. each, at 110 r.p.m., or sufficient to give the vessel a speed of 13 knots. She is a passenger liner with a total capacity for 762 passengers, including 109 of the first-class. She is for the company's Mediterranean service.

Latest advice from our Paris correspondent, whose source of information is an official one, is that there is every likelihood of the engines being of the Sulzer two-cycle type to be built at the St. Denis plant of the Compagnie de Construction Mécanique Procédés Sulzer who are associates and licensees of Sulzer Bros., of Winterthur, Switzerland. The matter of engine selection is the most interesting story and is not altogether free from French politics. The Services Contractuels des Messageries Maritimes are operated under the control of the French Government and has its financial support, this being arranged through the Department of Mercantile Marine. It is not a private independent company as is the Messageries Maritimes, which runs cargo vessels only. Consequently, all matters of importance acted upon by the Directors of the Messageries Maritimes so far as the Services Contractuels are concerned, have to be submitted to and approved by the French Government prior to execution.

When the question of Diesel engines for this new passenger liner came up a Committee of experts was appointed by the Under-Secretary of State, consisting of officials from the Department of Mercantile Marine and the Messageries Maritimes. After hearing favorable statements of the superintendent-engineer of the Messageries Maritimes, who had visited the Burmeister & Wain plant, they seemed inclined to adopt the Burmeister & Wain four-cycle Diesel. Difficulties then arose in Parliamentary circles and it was found that there was considerable opposition to placing the order with a firm which could not have the Diesel engine constructed in France. So, a second Committee was formed by the Under-Secretary of State for the Mercantile Marine, and in order to avoid bringing the question before the French Parliament, the Committee of experts were requested to make a careful study as to the possibilities and advisability of having the Diesel engines built in France.

Apparently there are very few French firms equipped for building Diesel engines of such high power, the others best qualified being the Chantiers & Ateliers de Saint Nazaire Penhoët, Schneider et Cie, Leflaive Co. and Augustin Normand, the only firm that has actually built a large motorship being the Penhoet Company, which built the MOTROCINE and her twin Werkspoor Diesel engines in 1913. The Chantiers de Bretagne, at Nantes, are licensees for the Cammellaird-Fullagar engine, while the Etablissements Leflaive, of Saint-Etienne, have built some large Diesel engines for stationary work and for submarine purposes at their Chaléassiere plant. This engine was formerly known as the Sabathé.

Regardless of this political situation, the chief consideration borne in mind by the members of the Committee is that of the reliability of the engine. They are realizing that all French steamship companies are watching with the keenest attention developments relative to their first experiments with oil-engines, because the question is one of national interest.

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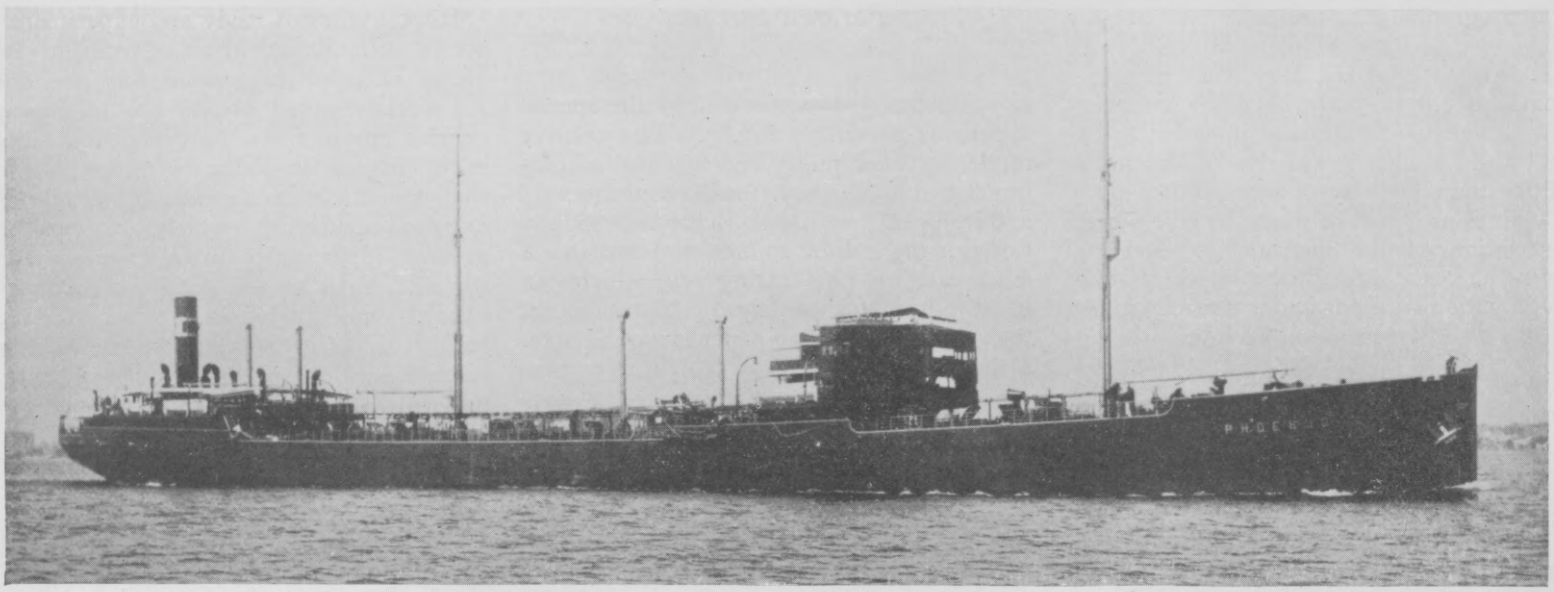
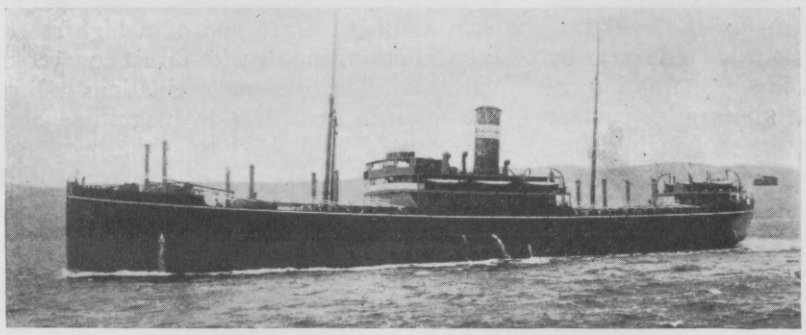
SOME RECENT SULZER MARITIME PRODUCTIONS

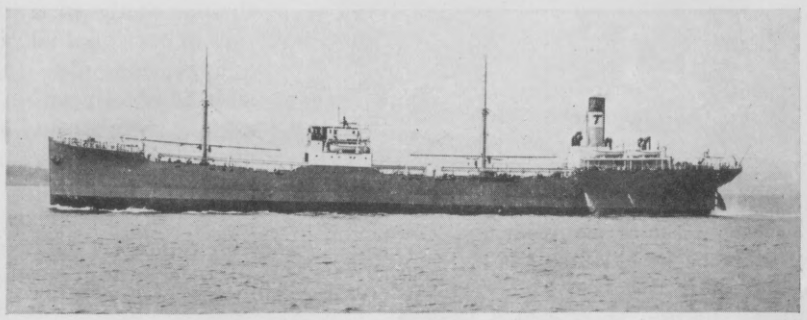
Switzerland is a long way from the sea, yet, largely due to the development of the Sulzer Diesel marine-engine at Winterthur there are more two-cycle engines than four-cycle sets building for large merchant ships according to Lloyds' recent figures. Sulzer have Diesel-powered 112 merchant craft.



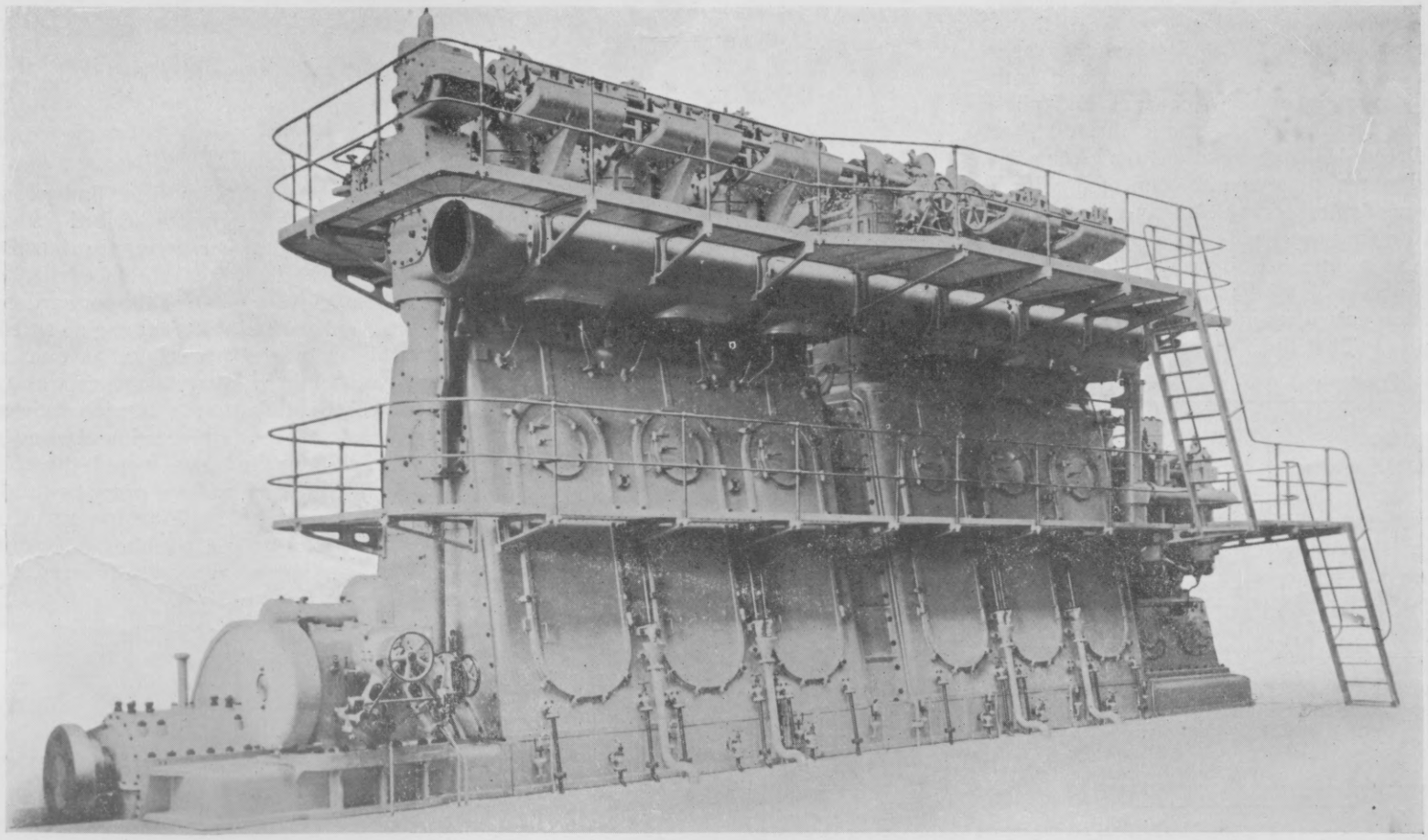
German tanker "Phoebus," 14,000 tons d.w.c., recently completed for Standard Oil interests. She is propelled by twin 2,000 shaft h.p. at 100 r.p.m. (1,600 s.h.p. at 85 r.p.m.) Sulzer Diesels. Voyage Kiel to New York— Speed 11 knots average on 14.3 tons fuel-oil daily including donkey-boiler. Voyage New York to Kiel — 11.12 knots average on 14.4 tons fuel daily. Total harbor maneuvers both engines, 318.



British-India freighter "Dalgoma," powered with two 1,350 shaft h.p. Stephen-Sulzer Diesel engines



Tanker "Scottish Borderer" propelled by twin 1,250 shaft h.p. Denny-Sulzer oil-engines turning at 90 r.p.m.



This six-cylinder 3,000 shaft h. p (4,000 i.h.p.) Sulzer Diesel is the highest powered marine-engine in commercial service. Four similar Sulzer engines, building at the Fairfield yard are being installed in the Union Steamship Co.'s new motor liner "Aorangi." Two four-cylinder sets of 2,000 shaft h.p. are installed in the Standard Oil tanker "Phoebus" illustrated above.

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Torsiograms and Vibrograms of Oil Engines

Simple Instruments Facilitate Exploration of Machinery for Critical Periodic Stresses

Articles have appeared from time to time in various countries referring to the subject of torsiographic measurements, and notably in the special Falk Supplement issued with the Motorship of last May. Such measurements should properly be made on every new design of engine, and in order to extend and broaden knowledge of the possibilities and simplicity of the practical study of vibrations it will be useful to give a brief description of the instruments used and show the results obtained with them in an investigation of a particular marine engine.

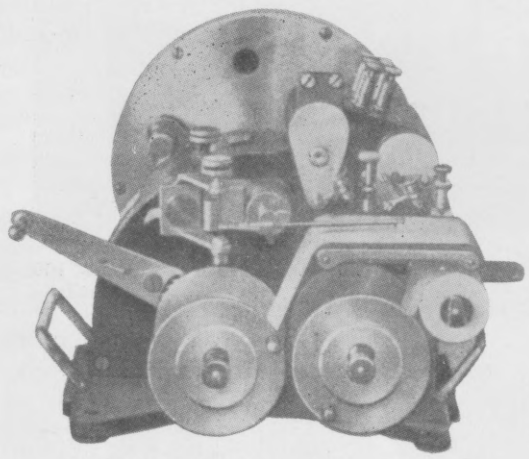

Fig. 1.—Commercial Geiger torsiograph

For the measurement of torsional vibrations in machinery a sensitive instrument, known as the torsiograph, is used, which in principle is similar to the seismograph employed in detecting and measuring earthquake motions. It has a light aluminum pulley (figs. 1 and 2) connected to the shaft under test by means of an inelastic, but light and pliable, belt. The moment of inertia of the pulley is so small that it responds readily to the minutest changes in the angular velocity of the shaft and faithfully reproduces the frequency and phase of the torsional vibrations in the test shaft and records their magnitude to a given scale. Inside the pulley, and connected with it through spiral springs, is a fly-wheel mounted on ball-bearings on a rotating spindle. These springs are so proportioned that the flywheel will tend to rotate with uniform motion notwithstanding the vibrations of the pulley. That this can be achieved has been experimentally demonstrated by the special apparatus shown in Fig. 3. The relative motion between pulley and flywheel is communicated to through the pivoted levers *f* and *i* (fig. 2) to a needle that passes axially through the hollow spindle and actuates a lever carrying the tracing pen, which can be adjudsted to magnify the vibrations on the graph. Recording paper is wound upon a drum driven either by a delicately governed clockwork mechanism or, if preferred, by connection through a gear with the aluminum pulley of the instrument. The essential is that the paper feed shall be uniform. Adjustment is provided for setting the rate anywhere between 8 ins. and 450 ins. per minute. Though the instrument is very sensitive, there is nothing about it that can get out of order very easily, and it withstands quite considerable handling.

What great progress has resulted from the use of the instrument for the investigation of torsional vibrations is made clear by a single example. Formerly it was impossible to obtain with a recording instrument a clear graph of vibrations of higher frequency than 500 per min. The torsiograph, however, will record vibrations having a frequency as high as 15,000 per min., and the results are not confined to laboratories nor even to favorable conditions. The instrument will make records even under adverse circumstances—for example, on the heated high-pressure end of a steam turbine or on a motor truck where the vibrations are very heavy. It can be used in positions other than the normal, even upside down if desired, and clear graphs can be obtained with the pen lever in a vertical plane, the ink in such case being capable of flowing three inches against gravity on account of capillary attraction.

It took years of study and experiment to arrive at the design of an instrument capable of accomplishing what this one does. As already noted above, the torsiograph enables one to trace the cyclic fluctuations in rotating shafts, which means for instance, that one can measure their amplitude and angular occurrence, which are very important, for instance, in oil engine generator sets, such as are used for auxiliaries aboard ship. In big engines, on the other hand, it is of greater importance to determine the critical speeds, with the magnitude and extent of their disturbance and their influence upon the shaft.

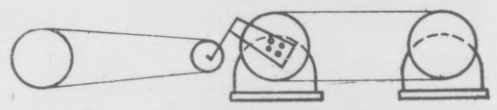

Fig. 3.—Apparatus to demonstrate the principle of the Geiger torsiograph

How heavy a critical vibration can be is shown in Fig. 4, which reproduces a graph taken at the forward end of a high speed six-cylinder oil engine with direct connected generator. The torsional oscillations in this case attained considerable magnitude and often caused in a short time the breakage of the shaft. Fractures of connecting-rod bolts, bearing cap studs, bedplates, flywheels, propeller blades and other parts frequently have their origin in destructive torsional vibration. Torsiographic measurements afford exact information on these matters.

The most important torsiograms obtained in tests on the 1,700 b.h.p. six-cylinder four-cycle Augsburg engine described in the Motorship of October, 1922, are shown in figs. 5-10. With the exception of fig. 10, these graphs were taken at the forward end of the crankshaft at different engine speeds. Criticals manifest themselves, as one can readily observe, in every case except at 120 r.p.m. According to the turning moment diagram there are six power impulses every two revolutions and one would therefore expect to find six vibrations every two revolutions. This is the case at 100 r.p.m. as may be seen in fig. 10, but the torsiograms in figs. 5-9 show many more every two revolutions, viz.,

12	vibrations	in Fig. 5
15	"	" Fig. 6
18	"	" Fig. 7
24	"	" Fig. 8
30	"	" Fig. 9

These conditions arise from the fact that the number of vibrations per minute of a harmonic turning moment included in the

Fig. 4.—Record of heavy critical vibration on six-throw crankshafts

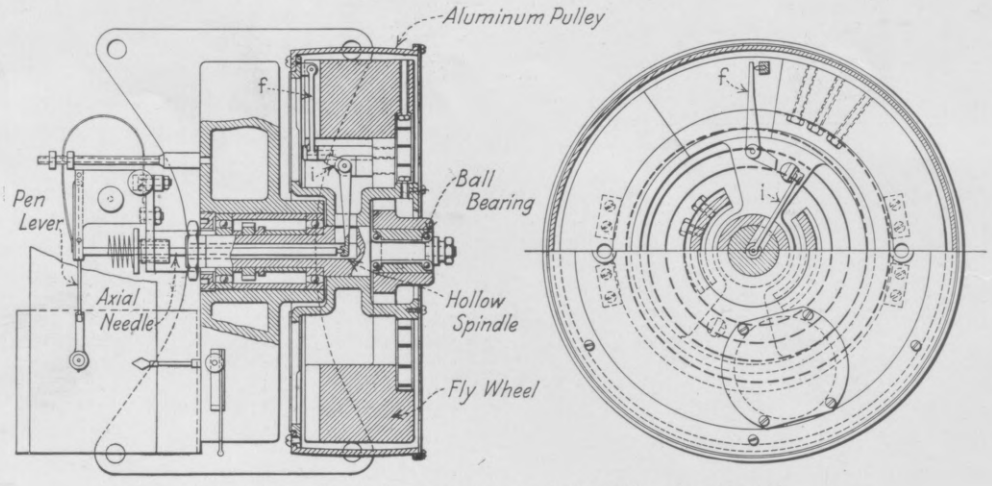

Fig. 2.—Mechanical arrangement of the Geiger torsiograph

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torque diagram, and ascertainable from it by means of a harmonic analysis; i. e. by development of the sine curve, coincides at the speeds in question with the natural frequency of the shaft system. With the natural frequency in this case equal to 810 per min., the critical which shows 18 vibrations every two revolutions will occur at $810 \div \frac{18}{2} = 90$ r.p.m. This is known as a critical of the 9th order, because it has nine vibrations per revolution. It follows that the particularly heavy critical of the 6th order, i. e., with twelve vibrations every two revolutions, will occur at 135 r.p.m. which is well above the normal engine speed. As it is a very heavy critical, it shows itself al-

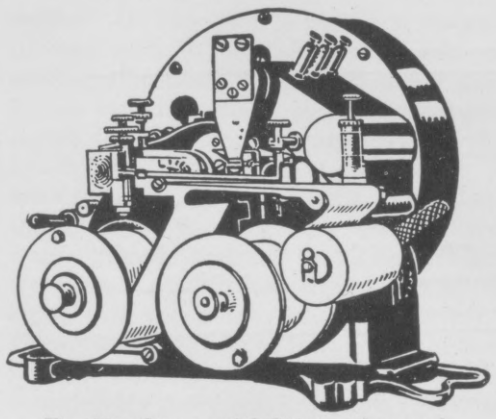

Fig. 20.—Commercial Geiger vibrograph

ready to some extent at a speed of 120 r.p.m., as can be seen in fig. 5, where there are twelve vibrations every two revolutions.

From the torsiograms one can thus deduce the conclusion that the whole range of speed from 50 to 120 r.p.m. is interlarded with critical speeds. A number of other torsiograms were taken in the tests, but as they show much weaker vibrations they are not reproduced. The installation, which was altered in accordance with the suggestions of the author as reviewed in the light of the comprehensive experience of the M.A.N., can be considered to have shown very favorable results from a vibro-technical point of view. The region of strong criticals which occur in six-cylinder four-cycle engines, namely, those of the 6th order, 4½ order and 3rd order, lies considerably beyond normal speeds. The weaker criticals occur in such a way that they do not coincide with the speeds for full-power, half-power or slow, and moreover they do not give rise to any really noticeable torsional vibrations. Without torsiographic measurement they would remain unobserved, even on close examination. The torsiograms shown in figs. 5-9 afford proof of the extraordinary sensitiveness of the instrument.

Critical speeds of crankshafts are the most generally mentioned in engineering literature. I will now deal, however, with a critical which showed itself on the vertical half-time shaft of the 1,700 b.h.p. Augsburg marine engine, because nothing has yet been published anywhere about vibrations in camshaft drives.

By listening to the camshaft at various speeds it was found that the noise of the camshaft gears was a little more pronounced between 105 and 110 r.p.m. than it was at either higher or lower speeds. On this account torsiographic measurements were made on the half-time shaft at top and bottom, as close as possible to the gears. A view of the graphs obtained are reproduced in figs. 11 to 14. They show very clearly that between 105 and 110 r.p.m. there occur rather strong and rapid vibrations, which by comparison with fig. 6 are demonstrated to be out of step with the critical vibrations on the crankshaft. The number of vibrations here shown per revolution of the camshaft corresponds exactly with the number of teeth in the upper driving gear. A close inspection disclosed a relatively unimportant error of workmanship. When this was corrected, the vibrations at all speeds were noticeably lower, but between 105 and 110 r.p.m. the destructive vibrations were still present. By substituting a camshaft of adequate strength, calculated by the author, the vibrations which caused criticals in the camshaft drive were completly overcome, as can be seen from the torsiograms in figs. 15, 16 and 17, taken on the vertical half-time shaft after the replacement had been made and as shown also on figs. 18 and 19 taken on the camshaft itself.

Besides torsional vibrations of the shaft system, there can occur vibrations of the engine as a whole, of the bedplate, of specific parts of the ship or of the ship as a whole. Fractures of rivets, bolts and joints can result therefrom, leading to salt-water leakage or to loss of fuel oil. For this reason it appears almost indispensable to pay close attention to them and to investigate them by absolute measurements as the M.A.N. firm has long been doing.

For this purpose one can use the vibrograph, which the author has developed from the torsiograph. In appearance this instrument looks very much like the torsiograph, as will be seen on reference to figure 20. This similarity is intentional, partly to facilitate the use of the two instruments, so that anybody experienced with the torsiograph can make use of the vibrograph, and partly

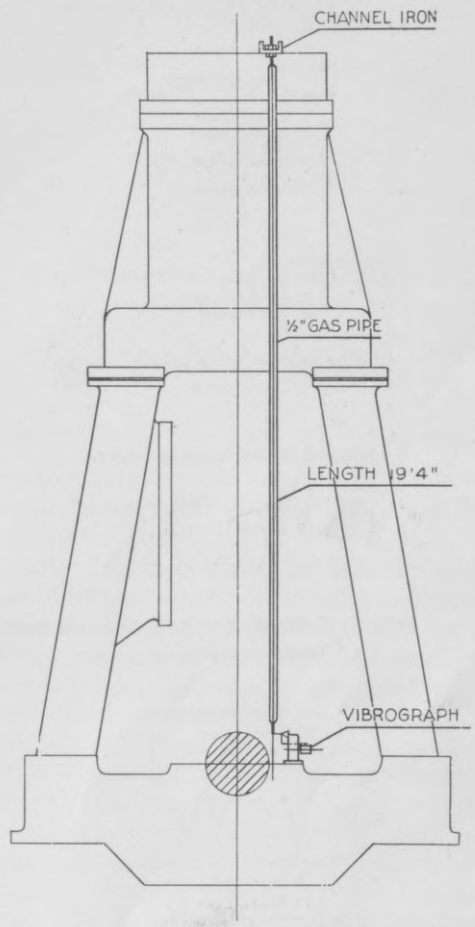

Fig. 36.—Device used in measuring engine elongation

to keep down the price of the instrument because many parts can thus be made interchangeable in the two types of apparatus.

In principle the vibrograph is similar to the seismograph already mentioned above. A suitable weight is so suspended within the instrument (see fig. 21) that it is unaffected by tremors in the frame of the apparatus The relative motion between the weight and the frame are transmitted through a suitable lever system to a pen which makes a record on a moving piece of paper. The advantages of this type of instrument over those previously used for the measurement of tremors, namely, the seismograph and the pallograph, are its light weight—which is only 13 lbs.—its diminutive size—it being so small that it can be placed on the palm of the hand—and its general usefulness—because, through adjustment of the weight, which is a very simple matter, it can be used for vibrations occurring not only in horizontal and vertical directions but in other directions. On account of its compactness it can be placed directly on bearing caps, cylinder covers or similar parts of any

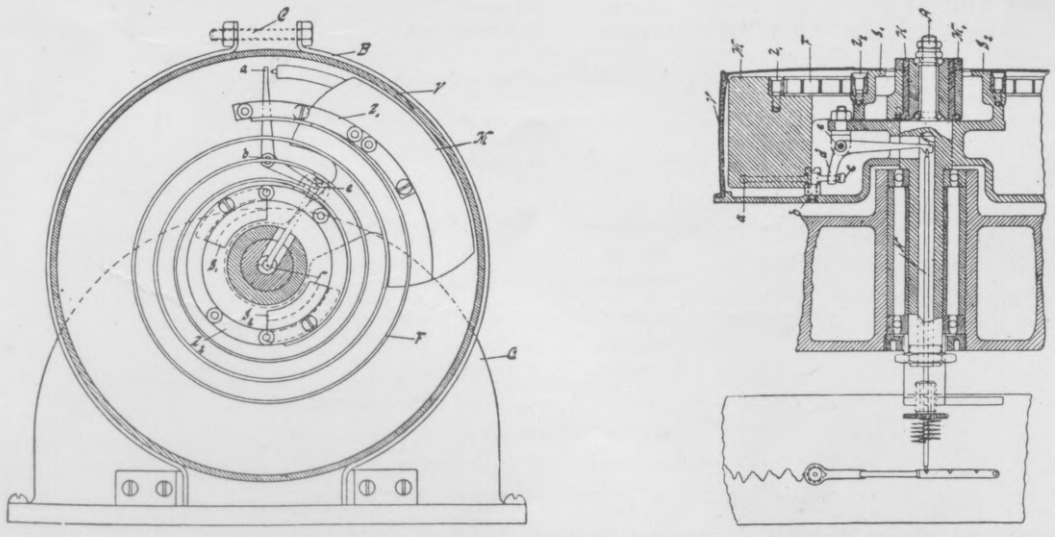

Fig. 21.—Mechanical arrangement of the Geiger vibrograph

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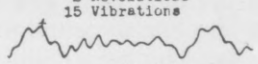
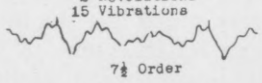
Fig. 5. 120 r.p.m.
2 Revolutions
15 Vibrations



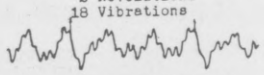
6th Order

Fig. 6. 108 r.p.m.
2 Revolutions
15 Vibrations



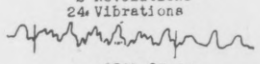
7½ Order

Fig. 7. 90 r.p.m.
2 Revolutions
18 Vibrations



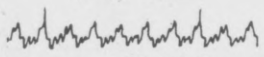
9th Order

Fig. 8. 67 r.p.m.
2 Revolutions
24 Vibrations



12th Order

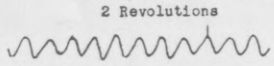
Fig. 9. 54 r.p.m.
2 Revolutions
30 Vibrations



15th Order

MEASURED AT END OF DYNAMO SHAFT.

Fig. 10. 100 r.p.m.
2 Revolutions



MEASURED AT BOTTOM OF VERTICAL HALF-TIME SHAFT.

a. Before Strengthening.

Fig. 11. 100 r.p.m.
2 Revs. of Camshaft
60 Vibrations

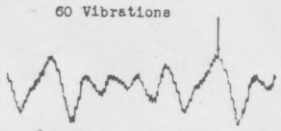


Fig. 12. 105 r.p.m.
2 Revs. of Camshaft
60 Vibrations

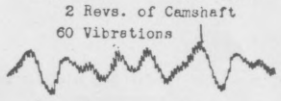


Fig. 13. 110 r.p.m.
2 Revs. of Camshaft
60 Vibrations

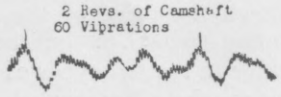
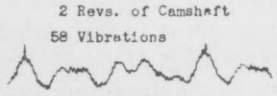


Fig. 14. 115 r.p.m.
2 Revs. of Camshaft
58 Vibrations



b. After Strengthening.

Fig. 15. 100 r.p.m.
2 Revs. of Camshaft
56 Vibrations

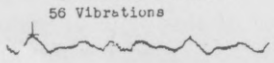


Fig. 16. 105 r.p.m.
2 Revs. of Camshaft
52 Vibrations

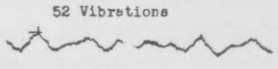
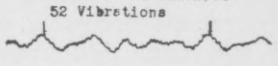


Fig. 17. 110 r.p.m.
2 Revs. of Camshaft
52 Vibrations



MEASURED AT END OF CRANKSHAFT NEAR CYL. #6.

MEASURED ON CAMSHAFT AT CYL. #6.

Fig. 18. 105 r.p.m.
½ Rev. of Camshaft 30 Vibrations.

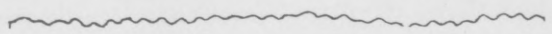
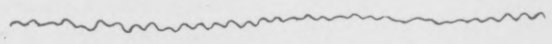


Fig. 19. 110 r.p.m.
½ Rev. of Camshaft 30 Vibrations.



VIBROGRAMS.

VIBRATIONS ON CYLINDER COVER #1.
In Horizontal Direction Transverse to Crankshaft.

Fig. 22. 65 r.p.m.
2 Revolutions 26 Vibrations

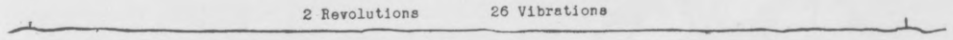


Fig. 23. 70 r.p.m.
2 Revolutions 24 Vibrations

Fig. 24. 75 r.p.m.
2 Revolutions 18 Vibrations

Fig. 25. 80 r.p.m.
2 Revolutions 14 Vibrations

Fig. 26. 85 r.p.m.
2 Revolutions 14 Vibrations

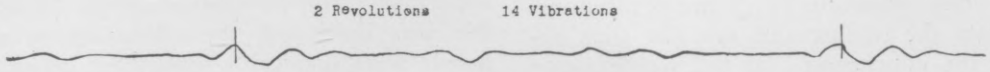


Fig. 27. 90 r.p.m.
2 Revolutions 12 Vibrations

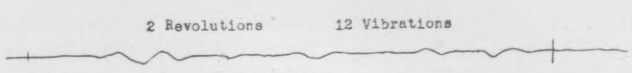


Fig. 28. 95 r.p.m.
2 Revolutions 12 Vibrations

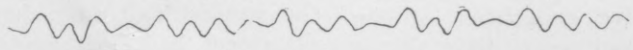


Fig. 29. 100 r.p.m.
2 Revolutions 12 Vibrations

Fig. 30. 100 r.p.m.
2 Revolutions 12 Vibrations

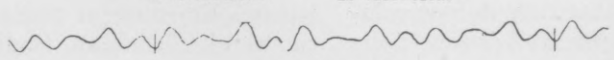


Fig. 31. 105 r.p.m.
2 Revolutions 12 Vibrations

Fig. 32. 110 r.p.m.
2 Revolutions 12 Vibrations

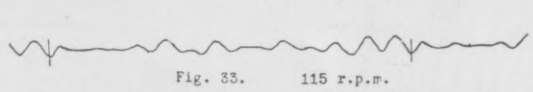


Fig. 33. 115 r.p.m.
2 Revolutions 12 Vibrations

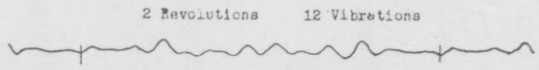


Fig. 34. 120 r.p.m.
2 Revolutions 12 Vibrations

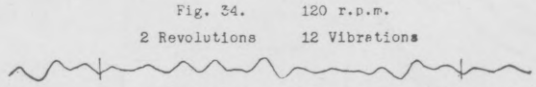


Fig. 35. 125 r.p.m.
2 Revolutions 12 Vibrations

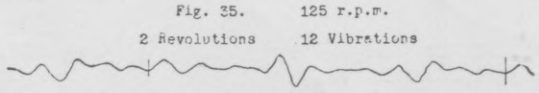


Fig. 5-35.—Torsiograms and vibrograms taken on 1,700 b h p. six cylinder, four-cycle Augsburg marine oil engine

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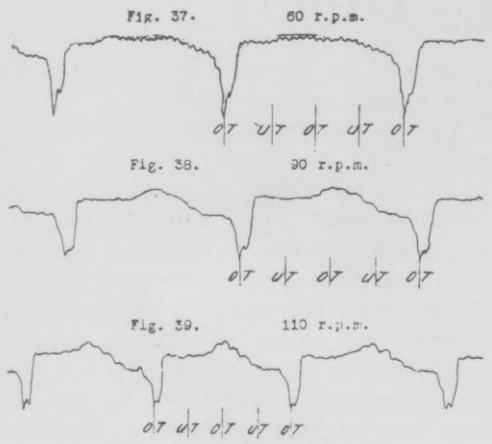
MEASUREMENT OF THE ELONGATION OF FRAMES.



engine. Its base can be placed at an angle or even vertical, and one can use it for recording vibrations, not only on engine parts, but on switchboards or switchboard instruments, for instance, or on any part of a ship. Vibrograms, illustrated in figs. 22 to 35, were taken on the head of No. 1 cylinder of the 1,700 b.h.p. Augsburg marine Diesel engine already referred to. These records were made at different engine speeds. In every case the graphs relate to horizontal vibrations transverse to the axis of the main shaft, which one can readily recognize were considerably more marked at 70 r.p.m. and at 95 r.p.m. than at other revolutions, due to the fact that at these two speeds, as can be mathematically shown, the horizontal deflections caused by the crosshead pressures become important.

At 70 r.p.m. and at 95 r.p.m. critical horizontal vibrations occur in the frame. They are, however, so relatively small that they can scarcely be detected by direct observation, the engine running with unusual smoothness. Yet they have a considerable influence on the engine columns and bolts and should therefore be avoided as far as possible if one seeks to attain maximum dependability and longest life. It is not difficult to get rid of them once their location and causes have been determined by vibrographic measurements.

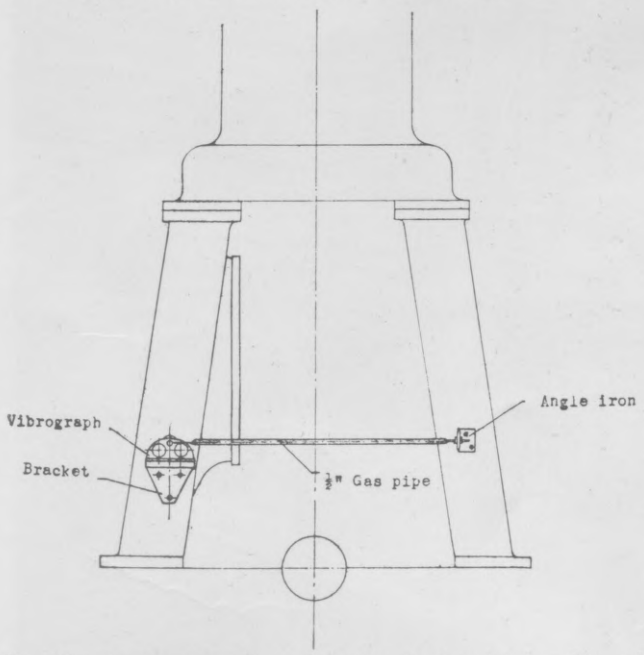
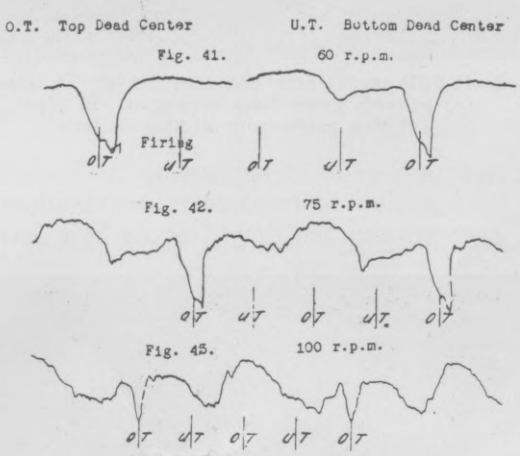


Fig. 40.—Arrangement for measuring horizontal bonding of columns

It is worth noting that with this instrument a number of other important measurements can be recorded, which are useful in checking up the design. To measure the elongation of the engine, for instance, one can use the arrangement shown in fig. 36. The suspended weight is removed from the vibograph and in its place is substituted a lever system substantially as shown in the sketch, where it is connected to a measuring rod 19 ft. 4 ins. in length. This conversion of the instrument occupies only a few seconds. The elongation diagrams thus obtained on the big Augsburg engine are shown in figs. 37, 38 and 39.

For the measurement of the horizontal bending of the engine columns an arrangement is shown diagramically in fig. 40. Graphs derived in this way are reproduced in figs. 41, 42 and 43, and show that after the ignition of the fuel in the cylinder mounted on these columns there occur a smaller and larger indentation at equal spaces along the line, showing ignition in two other cylinders. These marks on the graph are due to the bending of the columns caused by the effect of ignition in the two adjacent cylinders. The intervening mark on the upper side of the graph is due to the influence of the inertia forces acting upon the gross-head guide of the cylinder line on which the measurements were being made.

MEASUREMENT OF HORIZONTAL DEFLECTION OF BOTH FRAMES.



Another possible use of the vibrograph is shown in fig. 44. This proved to be of considerable importance in the case of the oil engine above mentioned. It is the recording of the tension in the engine columns. When one remembers that fractures have occurred in the frames and that the calculation of their sections is not a simple task, the advantage of a direct measurement of the tension in the columns during the operation of the engine will be obvious. In order to obtain a clear and comprehensive picture of the deflections, measurements were made on all four sides.

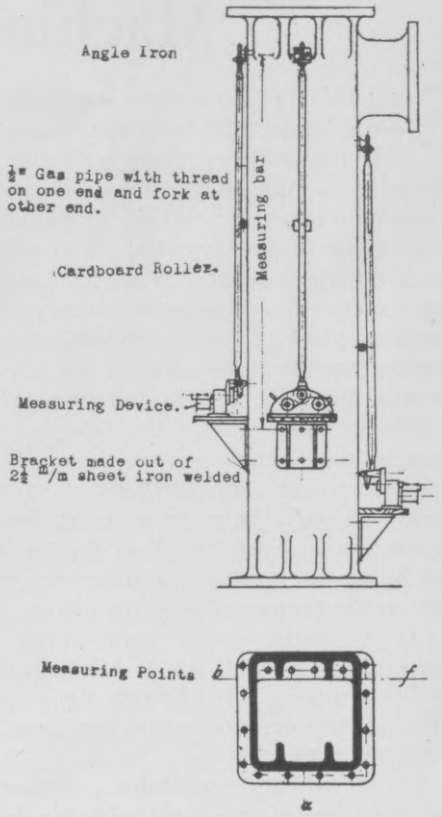


Fig. 44.—Using vibrograph for measurement of tension in columns

The graph obtained at normal engine speed on one side of the column is shown in tion is called to the stress caused by the flange connection between this column and the adjoining columns, which could not be calculated with anything approaching certainty. Although in fig. 44 a relatively large measuring bar is shown, one may note that this is not necessary. I have used with considerable success measuring rods only 10 ins. long, using at the same time magnifications between 500 and 1,000. This permits one to get very clear records, even with small and rapidly fluctuating strains. It is however, essential that the fitting of the pen lever should be entrusted only to specially trained men, because the best and finest workmanship is required. Also the taking of the measurements and the operation of the apparatus require a certain experience, especially in the case of high speed engines.

Whoever has once made use of the vibrograph and becomes acquainted with its many and varied applications, will soon learn to appreciate the instrument and utilize it for qualitative as well as for quantitative investigation of engines.

The M.A.N. firm, which has long recognized the value of these measurements, makes them now on all the most important and highly stressed machine parts, particularly those which cannot be exactly calculated and does this on all its leading types.

MEASUREMENT ON ENGINE FRAMES.

Fig. 45. Measuring point "f" Scale 1:135
100 r.p.m. half load.

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Machinery of "Motor-Steamer" Dolius

Scott-Still 1250 Shaft h. p. Combined Steam-and-Oil Engines Run Shop Tests. A Consumption of 0.356 lb. per S. H. P. Hour Attained

EXHAUSTIVE research, investigations, experiments, and tests carried out during the last few years with the Still principle,— combined oil-and-steam power, — have now taken practical shape in the form of the first commercial set of engines which during the last few weeks has been undergoing extensive test-bed trials at the Greenock plant of Scott's Shipbuilding and Engineering Co., Ltd.— one of the ten Still licensees in Great Britain and Europe.

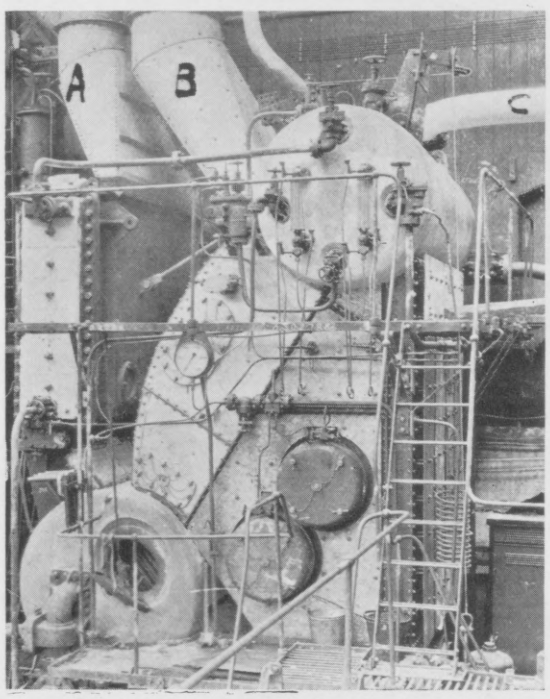
Recapitulating briefly the essential features of the Still system we find:

(1) A power cylinder in which operates a piston through the medium of the internal-combustion of liquid fuel on the top side, and by steam pressure produced by waste heat on the bottom side of the piston.

(2) A water jacket surrounding the power cylinder and being maintained by the heat, usually lost through the cylinder walls, at temperature equivalent to a certain steam pressure.

(3) A primary generator, regenerator and feed heater in circuit with the jacket for the purpose of absorbing the heat contained in the exhaust gases, thereby augumenting the temperature and equivalent steam pressure of the jacket water, the resultant steam to be used on the underside of the power piston.

The principal features of design and construction of the single cylinder experimental unit (described and referred to in several past issues of "MOTORSHIP") remain, yet a number of refinements, modifications, improvements and simplifications have been introduced on considering the requirement of a modern merchant ship.



Scott-Still regenerator and feed heater. A, pipe for exhaust gases from oil-engine. B, pipe for flue gases from oil-fired boiler

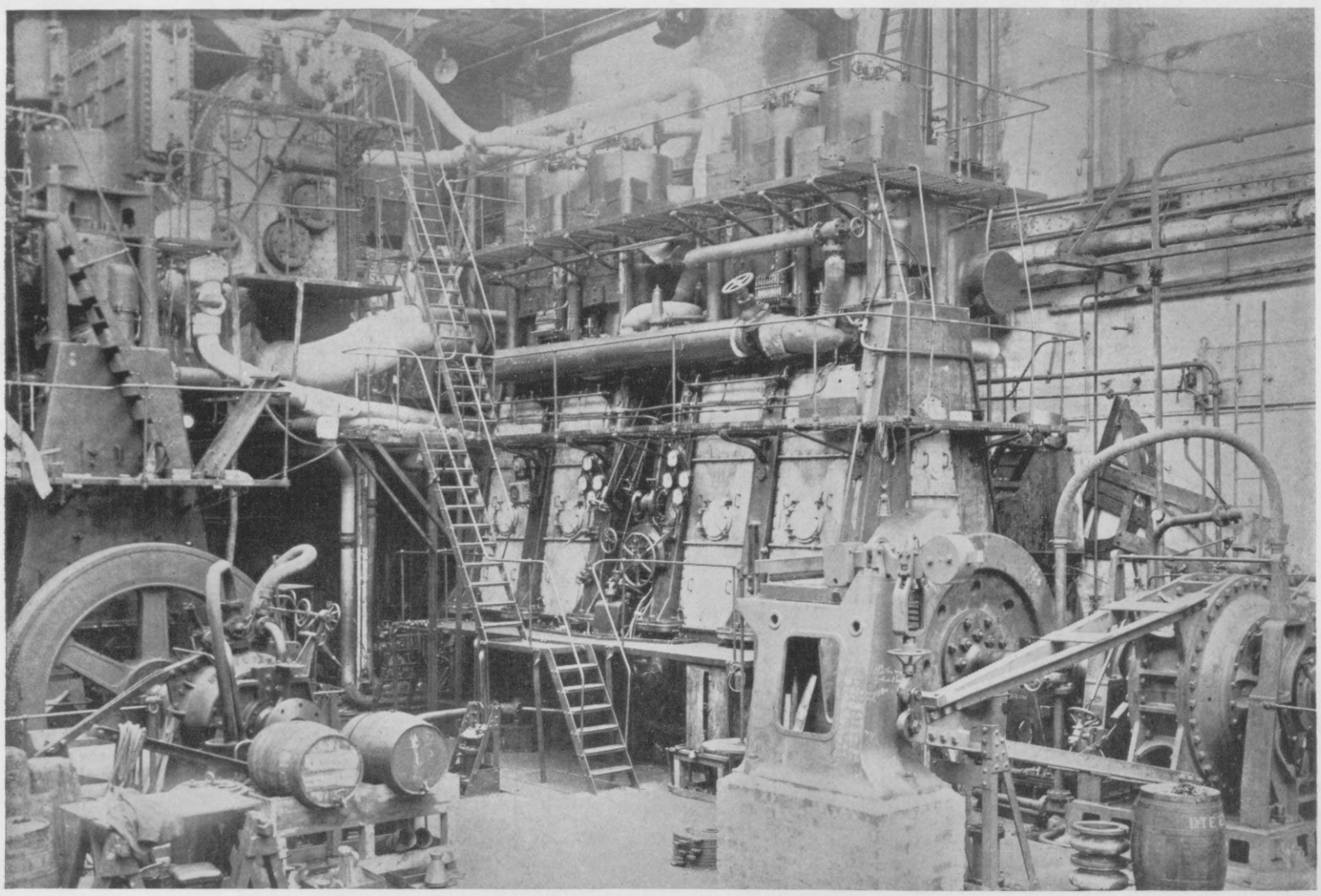
This pair of engines, designed to develop 2,500 shaft horsepower together at 120 r.p.m. are being installed in the twin-screw "motor-steamer" (we can find no better definition) DOLIUS, building to the order of Alfred Holt & Co., Liverpool, England. On tests, the noteworthy fuel consumption recorded was as low as 0.356 lb. per shaft h.p. hour, but the grade of oil is not given. This is very low, but 0.345 lb. per s.h.p. hour was attained by the new Burmeister & Wain double-acting four-cycle Diesel marine engine of larger cylinder output.

The "motor-steamer" DOLIUS has the following dimensions:

Displacement, loaded	11,650 tons
Deadweight capacity	8,000 tons
Power	2,500 shaft H.P.
Speed (expected)	11 knots
Engine speed, normal.....	120 r.p.m.
Range of Engine Speed.....	20 to 135 r.p.m.
Weight of two main engines (exclusive of boiler).....	268 tons

Weights of the boiler, water, etc., are not given so no opportunity is afforded for comparison with straight Diesel drive. This thus applies to the engine, dimensions of which are as follows: Each unit is 24 ft. long (over bedplate) by 9 ft. 3 in. wide, with a height of 20 ft. measured from centre of crankshaft.

In view of the recently completed official trials of this engine under the auspices of the Marine Oil Engine Trials Committee,



The twin-screw Scott-Still "motor-steam" machinery of the "Dolius" on the test-bed

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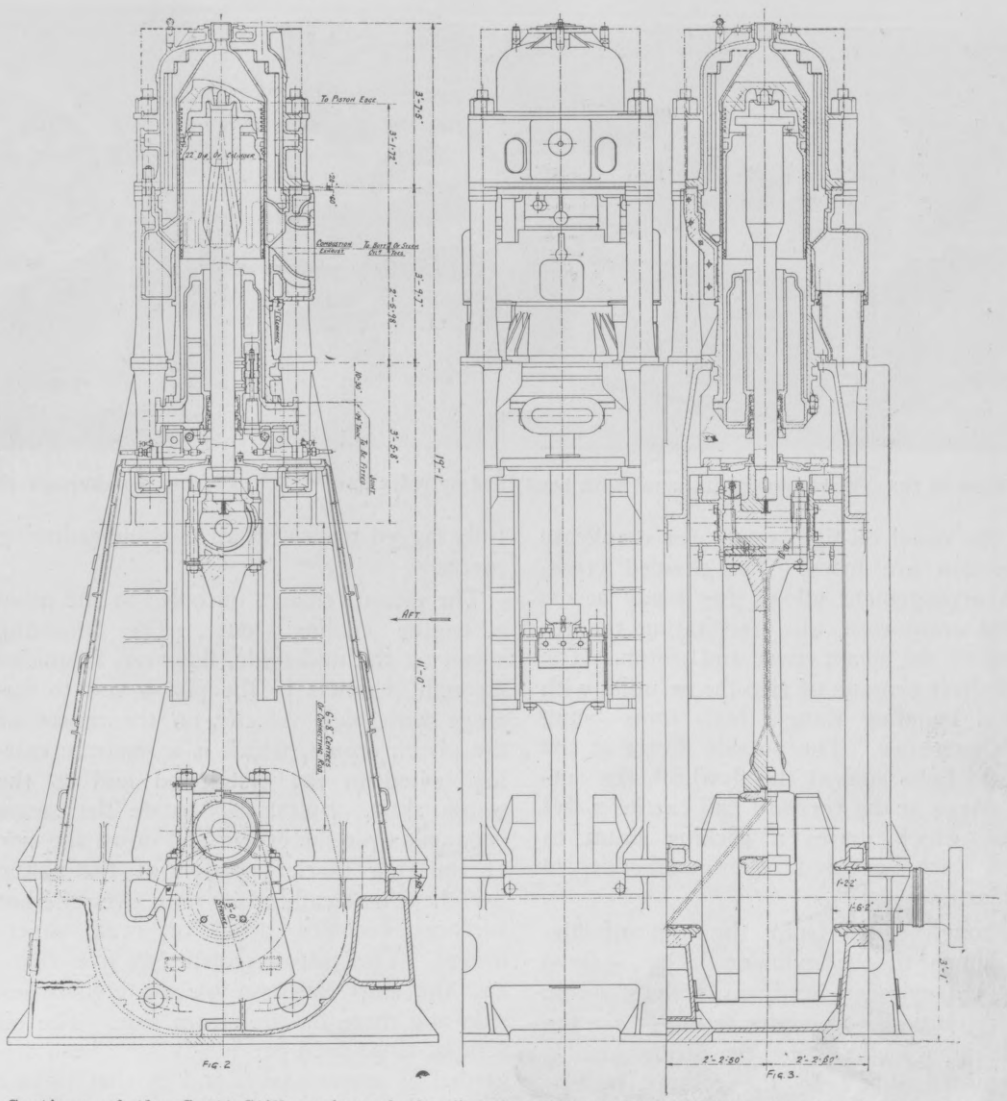
jointly appointed by the British Institutions of Mechanical Engineers and of Naval Architects, full trial results will not be available for publication until the report of that Committee is issued; but the following summary figures may be taken as typical of the results of full-load trials carried out by the builders themselves:

Average combusion, mean indicated pressure	77.8 lb. per sq. in.
Average steam, mean indicated pressure (referred to the combustion swept volume)	6.6 lb. *per sq. in.
Total mean indicated pressure	84.4 lb. per sq. in.
Revolutions per minute....	122
Total indicated horse-power	1425
Brake horse-power	1251
Mechanical efficiency	87.8 per cent
Oil consumption per B.H.P.	0.356 lb.
Steam evaporation per hour	2400 lb.

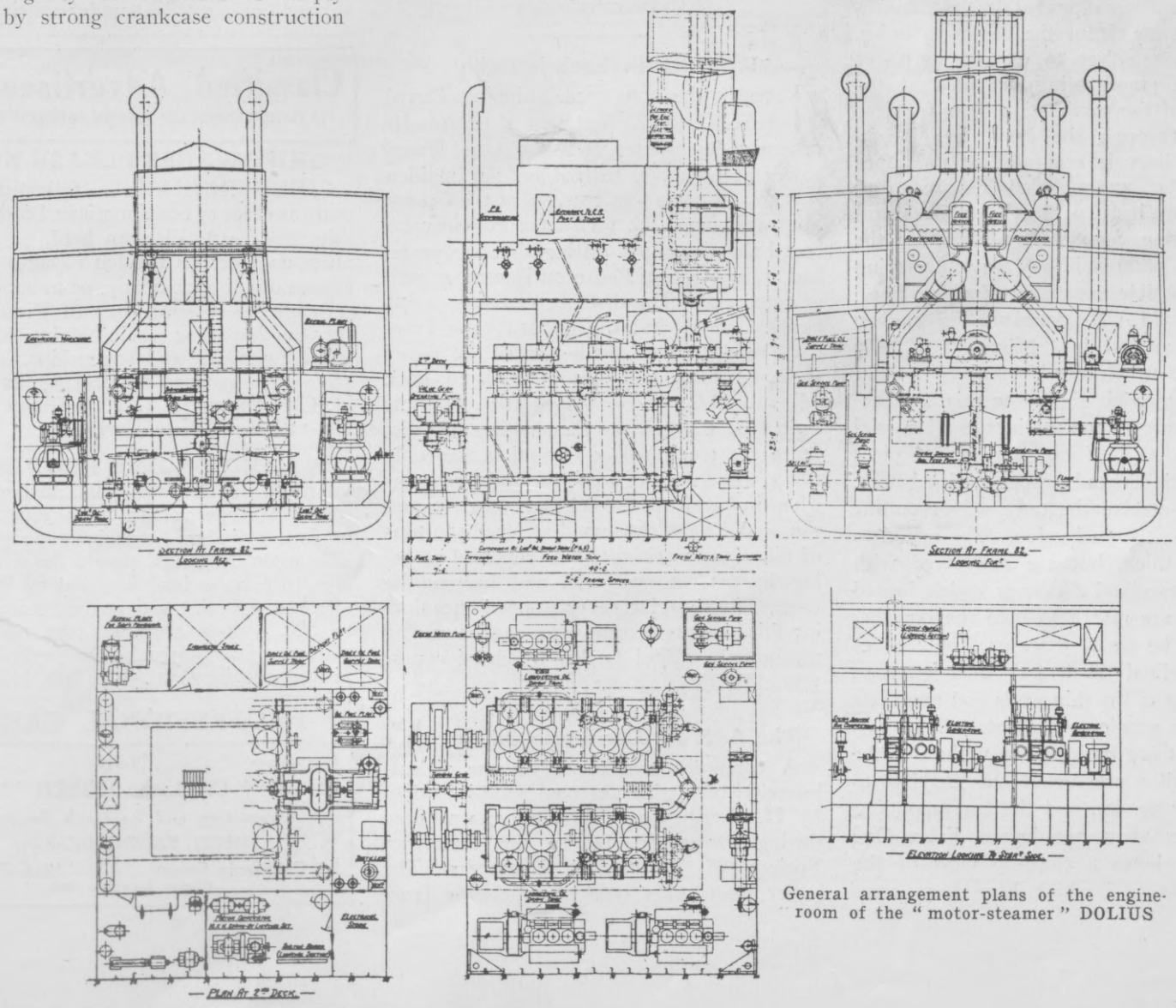
*Note.— This does not include the third-stage expansion in the low-pressure turbine driving the scavenge blower.

When the engines are installed in the ship it is expected that the fuel consumed will not exceed 0.36 lb. per shaft horse-power.

The general construction embodies a frame design with divided crosshead arrangement with split-guides, one-half carried by each column. As regards the crosshead construction, a saddle piece being attached to the upper side of the pin, a maximum width of the bearing is available for taking the pressure of the combustion side. The small end of the connecting-rod has half bearings, which take the upward pressure of the steam load. The crosshead is secured to the piston-rod by a cotter. Rigidity of structure is amply provided by strong crankcase construction



Sections of the Scott-Still engine of the "motor-steamer" DOLIUS — Combustion power on the upper side of the piston and steam power on the under side.



General arrangement plans of the engine-room of the "motor-steamer" DOLIUS

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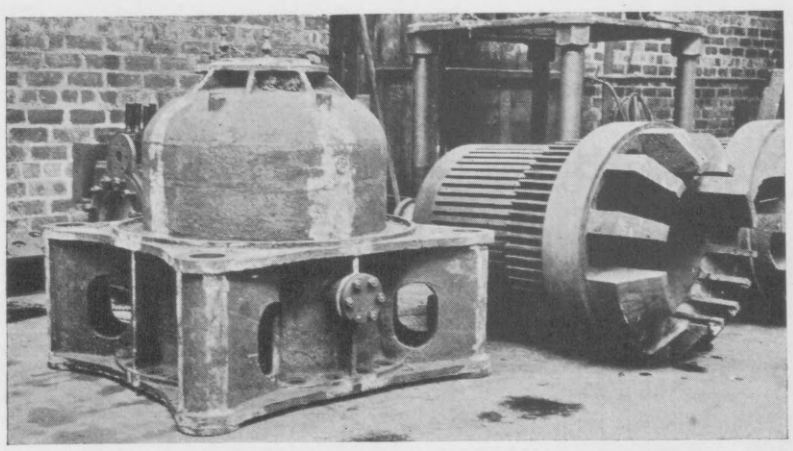
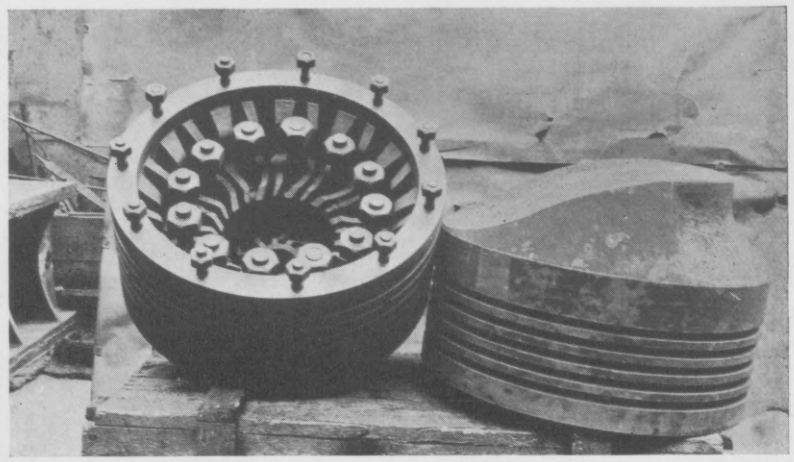


View of the cylinder jacket (integral with head) and cylinder liner



Combustion side and inside of Scott-Still design of piston

and the usual oil-tight doors for crankcase inspection are fitted. The divided cross-head arrangement allows for ready access to the crank-case, also facilitating the removal of the steam cover and piston. The crankshaft consists of two-throw units with central coupling flange, both units being interchangeable. The outside flange at the aft end bolts against the flywheel, the outside flange at the forward end carries a fly-crank, which drives a rocking beam to which are coupled the engine-driven auxiliaries.

Through bolts from the top of the A-columns to the cylinder jacket,— there being no cylinder heads as understood in the conventional oil engine sense,— take the combustion load, whilst the steam load is transmitted direct to the column by the supporting flange of the steam cylinder. The combustion cylinder is carried on short cast-iron standards mounted on the columns and is separate from the steam cylinder. Both liners are free to expand in either direction, a gland being provided at the upper end of the combustion liner for free expansion through the cast steel jacket. The steam liner is separated at its upper end and the water-cooled exhaust and scavenge-port bars mesh with these serrations, ensuring complete guidance for the piston rings without in any way interfering with any possible expansion of either liner. (The large M.A.N. double-acting engine, recently described in "MOTORSHIP" and "OIL ENGINE POWER" employs a construction somewhat similar to this arrangement). The combustion liner is of special Still construction of cast-iron in one piece with the cylinderhead proper, which has an opening to receive the only valves on the oil side, i. e., the fuel valve. The cylinders are 5/8 in. thick, but are reinforced with outside longitudinal ribs over which forged steel hoops are placed to take the bursting stresses. The liner, therefore, only takes the longitudinal load and heat stresses, which owing to the thin walls and moderate temperature gradients are low. The cast-steel jackets are designed to withstand the working boiler pressure from 120 lbs. to 160 lbs. per sq. in., and the corresponding temperatures, about 350 degrees Fahr. One illustration shows a close-up view of the cylinder "heads" which have been carefully lagged to protect all possible radiating surfaces.

The piston remains uncooled in the usual oil-engine cooling sense. The incoming steam on the underside, however, is guided through channels in the piston rod to impinge with high velocity on the centre of the piston crown, which is a separate casting bolted to the piston-rod and to the piston skirt. Spiral ribs guide the steam outwards over the crown and down the side of the ring carrier portion of the piston barrel. The steam on its path over the hot surfaces becomes dried or even superheated. The piston crown has five rings, and the skirt has two on the combustion side and three on the steam side. The oil scraper-rings used previously have been discarded as unnecessary, and in that respect the illustrations do not represent the very latest practice.

(To be continued)

What the Seekonk is Doing

Recently the converted Shipping Board vessel SEEKONK, installed with American-built Burmeister & Wain type Diesel power at Cramp's, started on her maiden voyage. A cable was received at the Cramp Shipyard from the guarantee engineer on board the SEEKONK stating that the vessel had arrived at San Pedro on December 12th at 7.30 a. m. The distance run was 4,873 nautical miles and the elapsed time from dock to dock was 463 hours, so the vessel averaged 10½ knots from dock to dock without taking into account the time lost in locking through the Canal. For this distance the total fuel consumption was only 149.7 tons, or 7¾ tons per day, whereas when in her former conditions as a steamer she would have consumed at least 450 tons of oil. Her machinery was reported as being in perfect condition and her single-screw Diesel engine never stopped once during this long run except when manoeuvering through the Canal Locks, which of course was obligatory.

The A. S. M. E. and the Oil Engine

A comprehensive paper on the airless-injection oil-engines, termed solid-injection, by H. F. Sheppard, its author, was read during December, before the American Society of Mechanical Engineers. The paper traced this type of oil-engine from its earliest development and gives drawings and discussions of systems now in use. We think the paper could have been strengthened by dealing more at length with Vickers system of airless-injection, in view of the fact that this company's efforts have been largely responsible for the present trend of development. Also, no reference has been made to the Otto Banner system of airless-injection as incorporated in the Falk oil-engine, yet probably more deep research work and experiments have been carried on with this design during the last three years than with any other system of airless-injection.

Another interesting paper read before the American Society of Mechanical Engineer was entitled "The Economic Status of the Diesel Engine," by L. H. Morrison, which deals principally with its uses and economy in power plants on land. One section of the paper deals with the use of waste exhaust heat under special boilers.

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USED ENGINE REQUIRED

Wanted, for experimental purposes, used two-cycle type vertical oil-engine in three or four cylinders — marine type preferred. The main bearings should have sufficient area to carry a load imposed by 9″ to 10″ diameter cylinder under compression of 400 to 500 pounds at 300 r.p.m. It doesn't matter if cylinder-heads, cylinders, or pistons are damaged. Box 600, MOTORSHIP.

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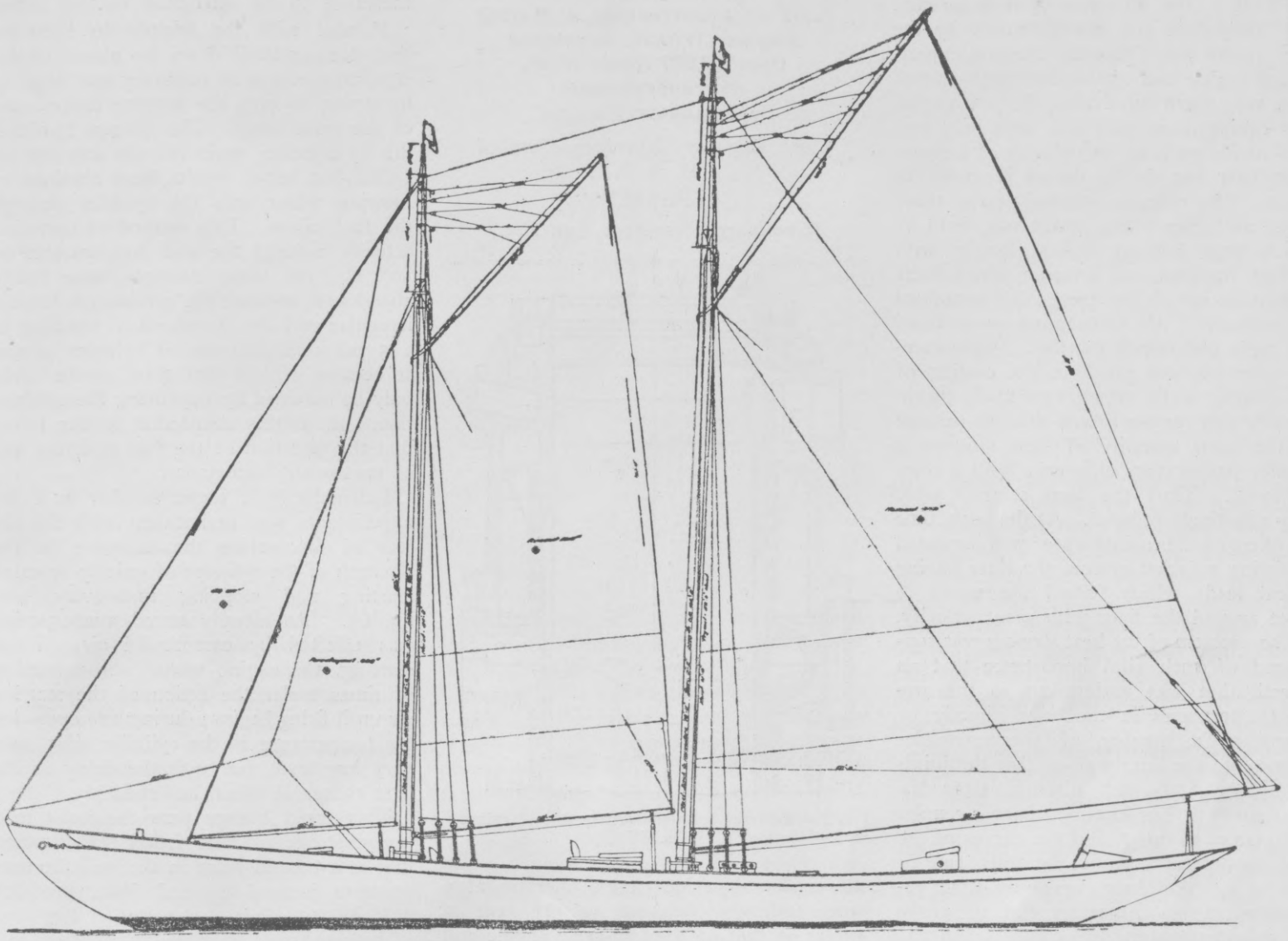
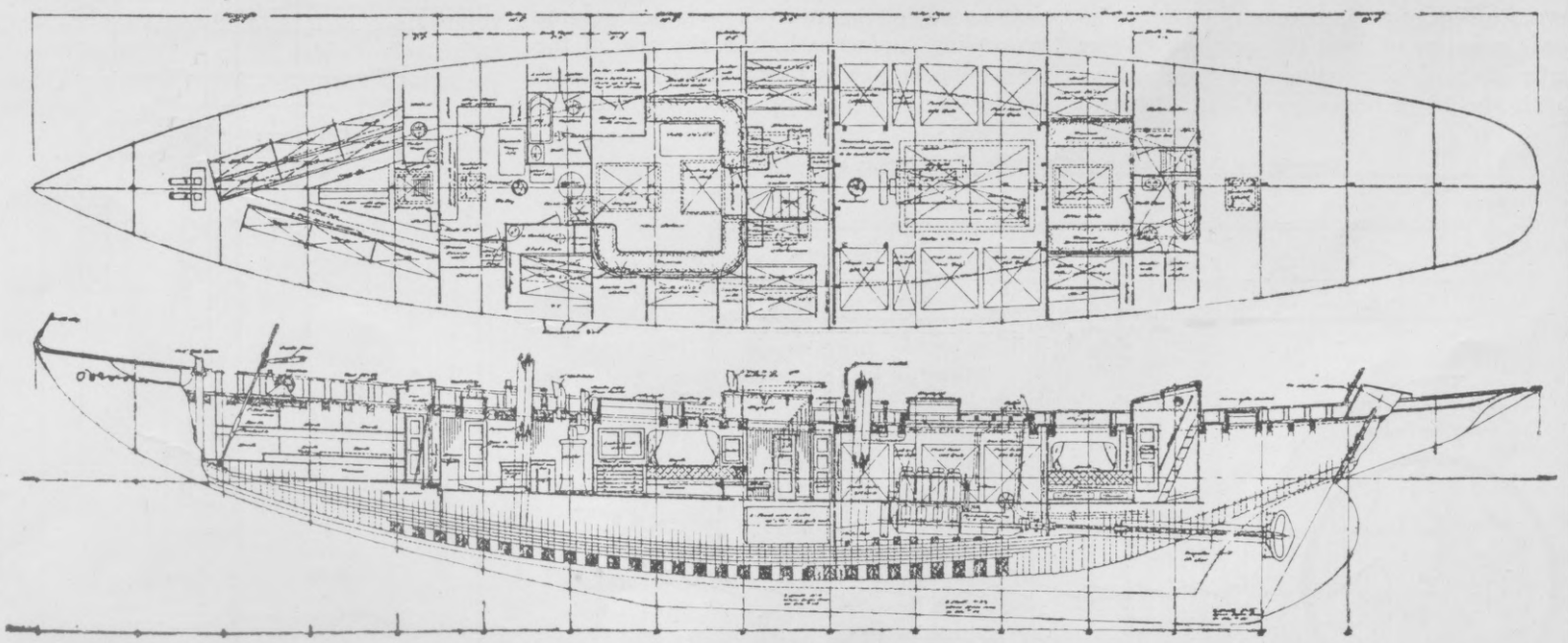
Oil-Engines Popular in the Yachting Field



Seagoing schooner yacht of 139 ft. length O.A. powered with a 140 b.h.p. Atlas Imperial Diesel-engine

Owner R. W. Allen, New York Yacht Club



Accommodation plans of 139 ft. auxiliary fishing-yacht built at James' yard. Essex, Mass. From design by W. Hand, Jr.

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How the World's Largest Diesel was Built

Special Story Relating How the Problems of Constructing a Marine Engine Which Developed Over 17,000 Shaft H. P. Were Overcome

By Frederick Englert,
Chief Engineer, Nürnberg Plant of M. A. N.

(Part II.)

(Continued from page 849, Dec.)

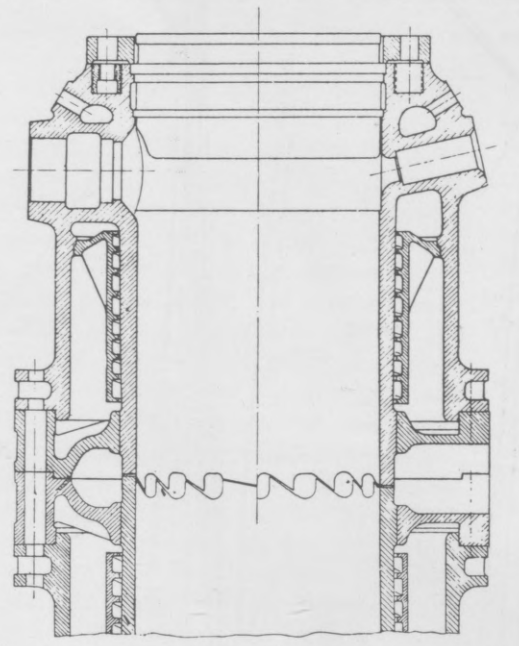

Fig. 1 — Referred to in the article as test cylinder No. IV

THUS the injection was somewhat tangential and not disturbed by the piston rod. Whereas the first experimental engine had combustion spaces which were very much subdivided, the new engine was equipped on each end with only two combustion pockets. A cylinder of a somewhat later but similar design is shown in fig. 1. This cylinder was built up of three parts, an upper and a lower one, both of which were left to expand axially with perfect freedom, and a center which itself was made up of two pieces and contained the exhaust. All three parts were fitted gas tight and bolted together. Very careful attention was given to the cooling of the cylinder walls, which were made exceptionally thin for the reason that the passage of the same quantity of heat requires a smaller temperature difference with a thinner wall. Thus the heat stresses were very effectively reduced. At the same time the effect of the cooling water was increased by fitting a jacket around the liner having helical leads which forced the water to shoot around the liner with great velocity.

The problem of the heat stresses was considered of such vital importance that an investigation was undertaken to measure the temperatures in the liner directly by means of a number of thermo-couples lapped into the liner wall so that the joints were only 3/16 inch distance from the inner surface. The location of these couples is explained in fig. 2, and the curves of the wall temperatures along the liner can be seen on fig. 3. These curves are again reproduced in fig. 4, together with the curve of the heat transfer.

For comparison, in fig. 5 are displayed similar curves found on a liner of a 1700 b.h.p. four-cycle submarine engine built by Krupp. (See Otto Alt, Problems of the Oil Engine, etc., Motorship, 1919.)

It is evident that a much greater temperature difference is necessary to force an equal quantity of heat through the thicker walls of the double-acting two-cycle engine. But it should be remembered that, although the small submarine engine operates at a mean indicated pressure 50 per cent in excess of that of the two-cycle engine and that therefore its maximum temperatures are accordingly higher, the increased number of cycles forces the wall temperature of the two-cycle engine up considerably. In this connection it must be emphasized though that the wall temperatures are also influenced by the ratio of cylinder volume to cooling surface, which in the case of the two-cycle engine is much smaller. A part at least of the temperature increase has therefore to be attributed to this cause.

Parallel with the attempt to keep the liner temperatures down by means of design, another line of endeavor was taken up by trying to keep the average temperature of the cycle lower. The attempt to obtain this by injecting water into the scavenge air failed, but better results were obtained by blowing water into the cylinder through the fuel valves. This method of operation actually reduced the wall temperatures by 50° C. All these attempts were finally abandoned, because the combustion became irregular and also deteriorated, resulting in a 5 per cent decrease of cylinder power. It became evident that good results could only be obtained by improving the combustion, and in this connection it was found that the direction of the fuel injection was of paramount importance.

Independent of these, another series of experiments was undertaken with the object of discovering the influence on the strength of the cylinder of quickly repeated starting and stopping maneuvers (see fig. 6). As already stated, maneuvering was effected by compressed air. When starting, the engine turns over a number of times under the action of the starting air until firing begins; during this operation the temperature in the cylinder sinks to a very low level, but with the firing of the first charge it shoots up suddenly.

This rapid change puts the walls to a severe stress. It was found, for instance, that at a certain point in the wall the temperature jumped up and down in quick

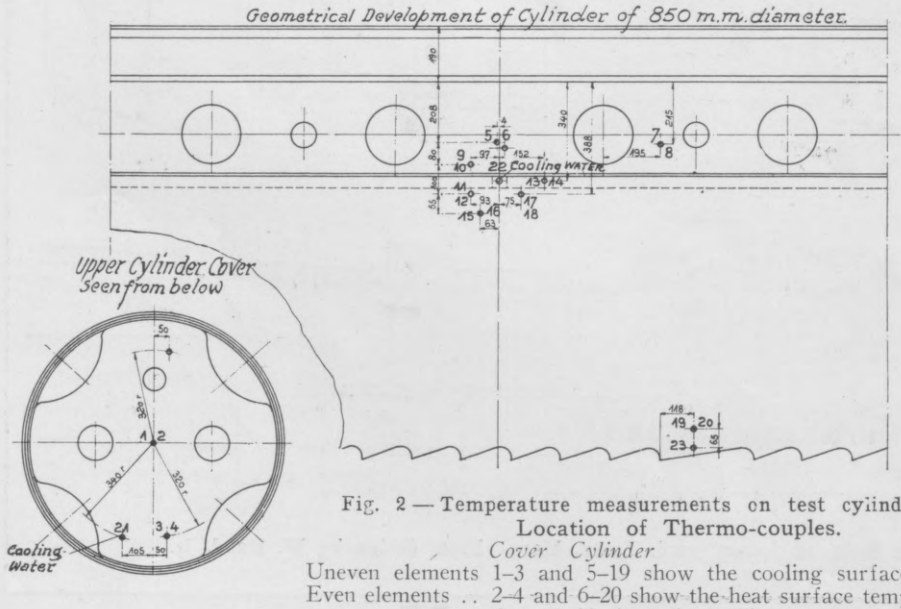
Geometrical Development of Cylinder of 850 m.m. diameter.
Cooling Water
Upper Cylinder Cover seen from below
Cooling Water

Fig. 2 — Temperature measurements on test cylinder No. IV
Location of Thermo-couples.
Cover Cylinder
Uneven elements 1–3 and 5–19 show the cooling surface temperature,
Even elements .. 2–4 and 6–20 show the heat surface temperature
21 and 22 show the cooling water temperature

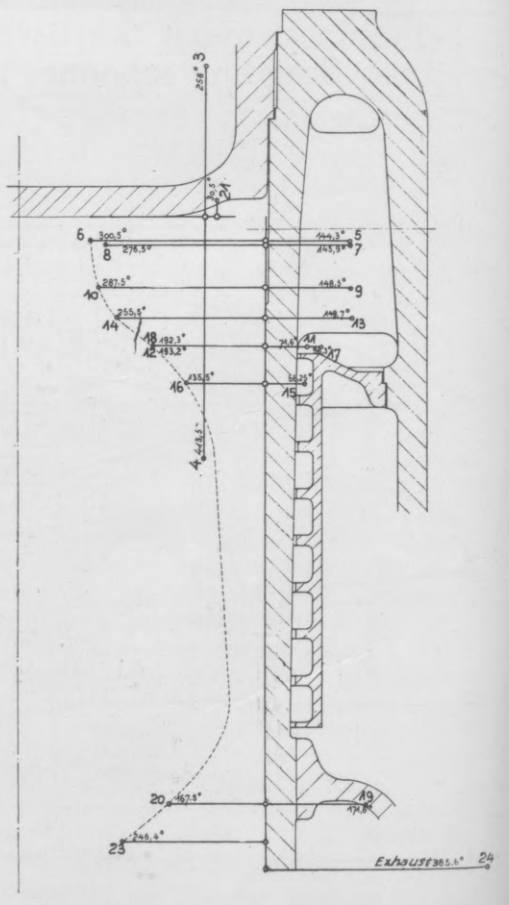

Fig. 3 — Temperatures of walls and cooling water in test cylinder No. IV
s.h.p. = 1,642 r.p.m. = 116

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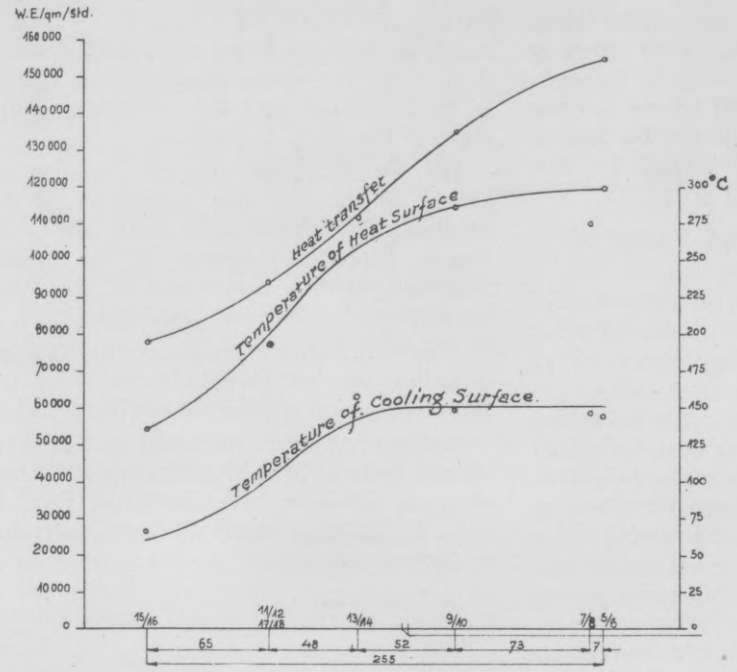

Fig. 4 — Chart of temperatures and of heat transfer relating to trunk of test cylinder No. IV

s.h.p. = 870 (upper end of cylinder)
r.p.m. = 116
m.i.p. = 6.3 kg/cm²

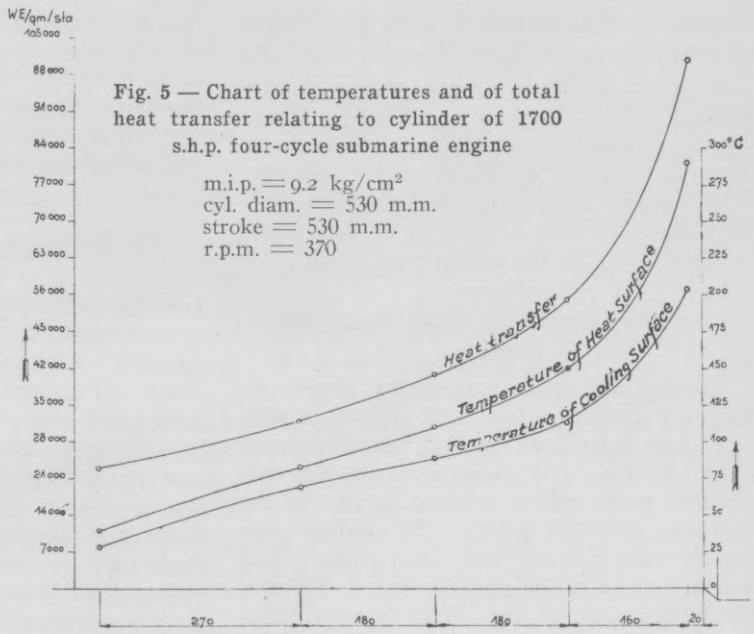

Fig. 5 — Chart of temperatures and of total heat transfer relating to cylinder of 1700 s.h.p. four-cycle submarine engine

m.i.p. = 9.2 kg/cm²
cyl. diam. = 530 m.m.
stroke = 530 m.m.
r.p.m. = 370

sequence between 400° to 300° C. Serious temperature conditions were found to exist at the cylinder heads. It was found that at 1550 b.h.p. the temperature of the firing side of the upper head was 350° C., of the cooled side 180° C. and at 1645 b.h.p. they were 415° and 260° C. respectively.

All the cylinders of the design shown in the December issue and all similar ones cracked after a short time, sometimes after a few hours. The cracks developed at the intersection of liner walls and valve chambers, and it was conclusively proven that they were due to impeded heat flow and to the inward expansion of the valve chambers. The cylinder walls were subjected to a severe heat strain which weakened their strength. When the valve chambers heated up, their expansion was restricted by the cylinder jacket; they grew inward and crushed the liner. The remedy for this trouble was found in the protection of these highly stressed parts against the heat by covering them with a water-cooled shield ring, which is the subject of German Patent No. 293,034.

A new upper cylinder part was developed embodying this feature, and at the same time the design of the valve chambers was once more altered. They were cut free from the outer jacket so that they could expand freely and packing boxes prevented the escape of cooling water. The new cylinder was fitted with a cast-iron shield ring, the location of the scavenge valves was changed, and at the same time means provided to measure their temperature. This became important, because during previous trials they had developed a tendency to burn off. Further, provision was made to determine the influence of the direction of the fuel injection on the temperature and the resistance of the parts exposed to the flame. It was found that the temperature of the scavenge valve varied to an extraordinary degree. At the same load, but dependent upon their location in the combustion space and the direction of the fuel injection, their temperature assumed values between 500° and 700° C.

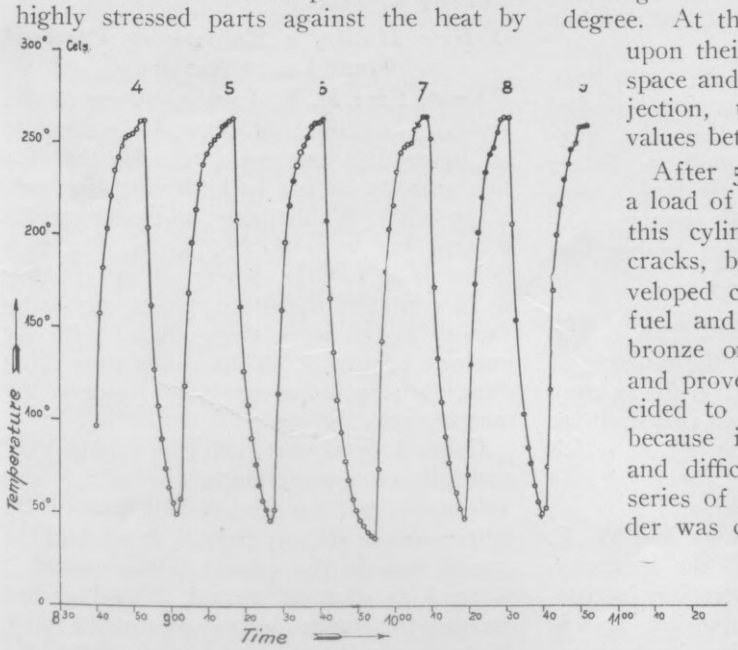

Fig. 6 — Temperature changes during manoeuvring trials on test cylinder No. IV

After 502 hours of operation with a load of 920 b.h.p. on one side only, this cylinder was found free from cracks, but the shield ring had developed cracks in four places at the fuel and scavenge valve seats. A bronze one was made to replace it and proved successful, but it was decided to discontinue its general use, because it was a very costly piece and difficult to produce. The usual series of experiments with this cylinder was carried out to determine the range of wall temperatures, which with the higher load were found to be 360° C. at the hottest part. Also about 150 starting and stopping maneuvers were made. The final result of this cylinder after 670 hours of running was that the upper part was cracked in two places, starting at the recess for the shield ring. The cracks were between ¾ inch to 2 inches long and only about .004 inch wide. Compared with the previous experiences, this result looked decidedly good, and, encouraged by it, a new, lower, part was designed on the following lines:

The valve chambers were again cast integral with the jacket because it was thought the shield ring protected them so well that they could not dangerously react on the liner. The wall thickness of the lower shield ring was cut down from 1 inch to 23/32 inch, and instead of the square recess on the liner a tapered one was provided. This necessitated the lengthening of the shield ring by 1 3/16 inches (fig. 7).

(To be continued.)

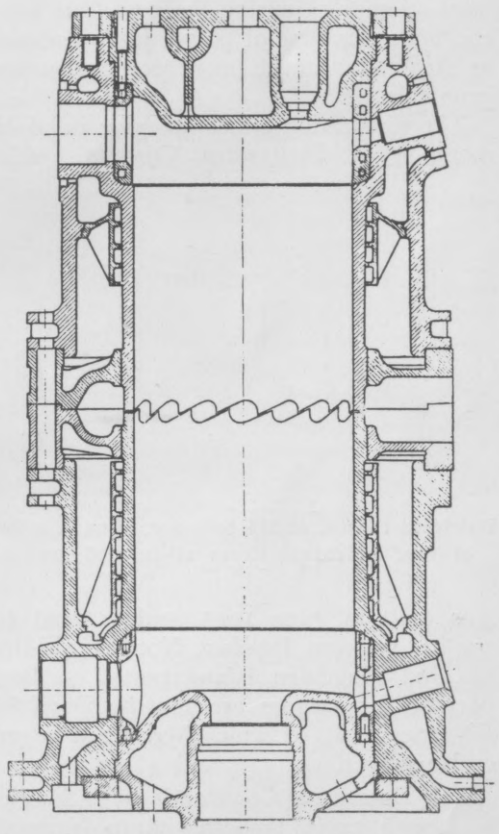

Fig. 7 — Test cylinder No. V

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Frederick Vanderbilt Orders Big Yacht

A 167 ft. motor yacht equipped with twin Burmeister & Wain Diesel engines aggregating 1,400 i. h. p., was recently ordered by Frederick Vanderbilt, of New York, from Burmeister & Wain, of Copenhagen. The boat will be full powered without auxiliary sail, will have a speed of 15 knots, and will be ready in the summer of 1924.

Another European Built Yacht for America

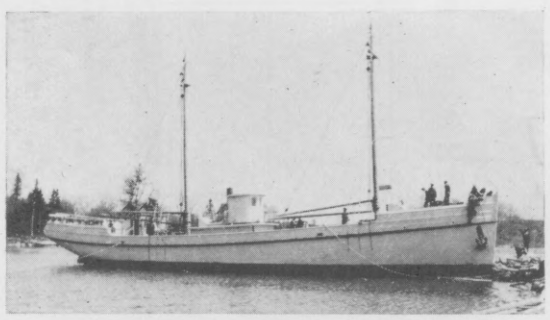
During the past year many large oil-engined motor-yachts, and Diesel-engines for American built yachts, were ordered from Europe, and indications are that additional boats will be ordered because of the comparatively low prices. On another page an illustration shows the ocean-going Diesel yacht VANADIS, designed by Cox & Stevens, being launched at the Fried Krupp Shipyard, at Kiel-Gaarden, Germany on November 15, 1923. She will be delivered to her owner, C. K. G. Billings, of New York, during January.

VANADIS is one of the largest full-powered Diesel-engined yachts, her dimensions being: length overall, 240 ft., beam 35 ft., draft 14 ft. She is twin-screw, driven by two Krupp Diesel engines which together develop 1,800 shaft h. p., giving her a speed of better than 14 knots. Fuel and storage capacity in all departments sufficient for a cruise of 12,000 miles has been provided. She is a fine able vessel capable of going anywhere in the world.

More Economical and More Profitable Than Steam

In a letter to the Editor of MOTORSHIP Mr. J. Foster Rood, of the Dominion Fisheries Ltd., Halifax, N. S., who has had 15 years' experience in owning steamers of various sizes and who has had built to his order some 17 vessels, states that he has used oil-engines during the past four years and finds this type of power just as reliable as steam, but much more economical and profitable.

The illustration which we give is of his motor-vessel DOMINION COASTER, which



Dominion coaster of 275 tons d.w. One of a fleet of four Fairbanks-Morse oil-engined vessels

was built in June 1923, and is used for trading between Halifax, North Cape Breton and Magdalen Island ports. A large part of the cargoes are for the Dominion Fisheries Ltd., of which Mr. Rood is general manager.

The DOMINION COASTER is 95 ft. long on keel, with 23 ft. breadth and 10 ft. depth. She is fitted with twin 75 b. h. p. Fairbanks-Morse oil-engines, giving the craft a speed of 9½ knots to 10 knots. Her carrying capacity is 275 tons. She is fitted throughout with electric lights and carries a crew of 7 men. She is the fourth Fairbanks-Morse oil-engined vessel owned by Mr. Rood.

Performance is a Real Factor of Economy

When a ship makes a non-stop voyage from Panama to Sydney, a distance of 7,847 nautical-miles at an average speed of 12 knots, on a daily fuel-consumption of 12½ tons (12.6 tons to be exact) it is something to write home about. What does the higher cost of Diesel power matter when such economical results can be secured? Perhaps there are shipowners who, knowing what their own steamers do, are somewhat prejudiced and doubt that a ship could put up such a performance. But, facts are facts, as this was actually done by the MOTORSHIP DURENDA, which broke the record of a voyage from New York, U. S. A., to Sydney, Australia via Panama, which was completed in 35 days. Altogether her round voyage from England, America, Sydney and back to England totaled 26,933 miles accomplished at an average speed of 11.2 knots on 11.5 tons of fuel-oil per day without a hitch of any kind.

The DURENDA is of 10,850 tons d. w. c. and of 14,700 tons loaded displacement. This means that this big ship, carrying both passengers and cargo, covers a distance of 100 sea-miles on less than 4½ tons of oil.

Log Towing by Oil-Engine Power

Several motor tugs belonging to Vancouver, B. C. have recently been engaged in log towing, their owners experimenting in this particular work. It is found that, apparently, there is still room for improvement in the propellers of these boats, and effective proportion of pitch and diameter speed will shortly be worked out. The boats are giving reasonably good results. The Tug CZAR owned by the Czar Tug Boat Co., and equipped with a 350 h. p. Bolinder oil-engine, unfortunately, ran on the rocks when towing her first boom of logs, but has since been repaired.

The SEAWAVE equipped with a 200 h. p. Pacific-Werkspoor Diesel engine, handles about 26 sections of log, while the NORSHORE, powered with a 420 h. p. Sulzer Diesel engines comes nearer the large steam-engined tugs employed in this country, having towed 38 sections of logs on her first tow.

Westinghouse Marine Log

We have received through the courtesy of the Westinghouse Elec. & Mfg. Co., a copy of a most interesting book just issued, under the title WESTINGHOUSE MARINE LOG, which is devoted to electric-drive for main and auxiliary engines on board ships.

The feature article is one by Mr. W. E. Thaw, Marine-Engineer of the company, giving information and operating instructions on Diesel-electric propulsion, and is fully illustrated with drawings and photographs. Another article is entitled "Why the Navy Uses Electric Drive for Battleships," by Capt. Richard H. Leigh, U. S. Navy, which is followed by an illustrated description of the propelling machinery of the U. S. S. COLORADO, and the propelling equipment of the U. S. S. OMAHA.

Mr. W. E. Thaw has also written an article on the electrical auxiliaries of the MOTORSHIP CALIFORNIAN; while Mr. G. A. Pierce, Electrical-Engineer of the Cramp Shipyard, gives a description of the WILLIAM PENN'S electrical deck machinery.

There are many other interesting articles, including one on Diesel-electric drive for ferry-boats, and another on auxiliary yachts.

Readers who are interested in this book should write to Mr. P. A. Sensenig, Motorshipping Division, Westinghouse Elec. & Mfg. Co., 165 Broadway, N. Y. C., referring to MOTORSHIP.

Auxiliary schooner "O Newhouse" owned by J. L. Larsen and powered with a 55 h.p. Kahlenberg oil-engine.

O New House, a Kahlenberg Powered Great Lakes Auxiliary

From Capt. J. L. Larsen, owner of the auxiliary schooner O NEW HOUSE comes an interesting letter. He tells us that for two seasons he has had, driving his boat, a 55 b.h.p. Kahlenberg oil-engine which propels her at 6 to 6½ knots. She is a heavy load for the power of her engine, so he considers the speed results very satisfactory and is more than pleased with the engine's operation, all the ship's runs being long. A stop is never made unless the weather gets too bad.

Capt. Larsen watched the engine very carefully on three trips, one of which was 106 hours, and the others of 95 hours each. There was never any trouble at all, and the engine was in the same condition when it stopped as when it started. Good or bad weather the engine always operates the same. No runs are less than 50 hours. Often the vessel has to go up the Chicago River, which he considers a maneuvering test for any boat.

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Notes and News From Everywhere

Norwegian motorships earned Kr. 30,000,000 for their owners during the year 1922–23.

The Mercur Reederei and Handels A. G., Hamburg, have decided to order a new motor vessel for the coastwise trade.

Recently the East Asiatic Company's motorships TONGKING and JAVA ran ashore in fog. Both were refloated with but slight damage.

The motorship ORONITE owned by A. F. Thane & Co., San Francisco, is being reconditioned and operated in the Pacific as a copra carrier.

Seven hundred and ninety motor-vessels were inspected and certificated by the U. S. Department of Commerce, during the fiscal year ending June 1923.

OSWIGA, a 960 tons d.w. cargo boat driven by a 500 h.p. oil-engine, ran trials at Boizenburg, where she was built by the North German Union Works.

The auxiliary and pumping machinery of the 12,800 tons d.w. motor-tanker building at Burmeister & Wain's for Knut Knutson, will be Diesel-electric operated.

A 60 ft. tug powered with a 65 b.h.p. Atlas-Imperial oil-engine is being built for the Arrow Tug & Barge Co., by the Wilson Shipbuilding Co., Astoria, Ore.

According to information received, the 10,000 tons lake ship SNYDER JUNIOR may be converted at Buffalo this winter, with a 3,000 h.p. Sun-Doxford Diesel engine.

Last month we received an order for a year's subscription to MOTORSHIP from a man in Death Valley, Calif., the last place one would expect to find MOTORSHIP.

Now nearing completion at the Burmeister & Wain plant is a Diesel propelled passenger vessel of about 275 ft. length and 1,600 i.h.p. for the Copenhagen-Bornholm Line.

The Golden Gate Ferry Co. have combined with the Six-Minute Ferry Co., of Valejo. Four additional Diesel-electric ferries are planned if the re-financing is successful.

The U. S. War Department's 24-in. pipeline dredge, of which drawings were given some months ago in MOTORSHIP, is due to be launched this month and run trials about May 1st.

DOLIUS is the name given to the motor-steamer building for Alfred Holt & Co., of Liverpool, in which twin 1,250 shaft h. p. Scott-Still combination oil and steam engines are being installed.

Burmeister & Wain will construct the Diesel engines for the large motorship recently ordered from Workman, Clark, of Belfast, by Alfred Holt & Co. (Ocean S. S. Co.) of Liverpool.

EMMA MAERSK, an 8,000 tons Burmeister & Wain Diesel-driven motorship was recently launched at the Odense Shipyard, Odense, Denmark, to the order of the Steamship Co. of 1912, Copenhagen.

NORBO, the 8,000 tons Diesel-engined motorship recently referred to as having been built by Burmeister & Wain, has just been handed over to her owners, the Norden Steamship Co., Copenhagen.

CAMRANH, the Chargeurs Reunis Co.'s new 11,700 tons d.w. Sulzer-engined motorship, was recently launched at the Loire Shipyard, Nantes, France. Her loaded displacement will be 17,097 tons.

Two 6,550 tons, 2,600 i. h. p. motorships building at Burmeister & Wain's for delivery in 1924 and 1925 for the Nordenfjeldske Steamship Co., have been taken over by Lauritz Klosten, a Norwegian shipowner.

Three motor tugs have been ordered by the Atlantic Refining Co., Phila., a Standard Oil subsidiary, from the Staten Island Shipbldg. Co. N. Y. In each of these vessels Ingersoll-Rand oil-engines will be installed in conjunction with electric drive.

The 2,000 tons d. w. wooden auxiliary schooner CAP NORD, built during the war at North Vancouver, B. C. and fitted with twin 250 shaft h. p. Atlas-Imperial Diesel engine, was recently sold at auction in London.

LOCHMONAR, a 9,500 tons motorship with twin 3,000 b.h.p. Harland & Wolff-Burmeister & Wain Diesel engines was launched at Belfast, during the first week in December last. She is a Royal Mail Line vessel.

There is a possibility that Diesel-electric drive will be installed in the new passenger-cargo motorship on which the Matson Navigation Co. have asked bids from shipbuilders. The vessel is for the San Francisco-Honolulu run.

Last month, through an oversight, we omitted to credit the Westinghouse Elec. & Mfg. Co. for the excellent photograph of the motorship SEEKONK reproduced on page 835. We are indebted to the Company for its courtesy.

PILOT No. 3, an 85 ft. by 16 ft. 9 in. boat, ran her trials on Nov. 9th. She is owned by the Royal Dutch Navy's Pilot Dept. and is propelled by a 200 b. h. p. Polor two-cycle Diesel engine. Speed 10½ knots. She will operate at Flushing.

"Shipping opinion," says The New York Herald, "although not unanimous, inclines more and more to the conclusion that the motorship provides the surest answer to the question of how operating costs may be reduced to offset diminishing earnings."

CESARE is the present name of the old 410 tons gross motorship CORNELIUS built in Holland about 1908 and powered with a four-cylinder 12⅝ in. by 16 9/16 in. four-cycle Werkspoor Diesel engine. She is now owned by Capt. L. Martini, of Camogh.

When he was in England we interviewed Chairman Edward P. Farley, of the Shipping Board, says the Editor of "SHIPBUILDING & SHIPPING RECORD," and came away with the impression that the United States has been forunate in its choice of the S. B. Chairman.

The Howaldtswerke, of Kiel, recently delivered the FORTUNA, a twin-screw 545 gross tons motorship to the China Reederei A/G, of Hamburg. Two four-cylinder 10¼ in. by 14⅜ in. Benz oil-engines are installed. Length 151 ft., breadth 27 ft. 5 in., depth 12 ft. 6 in.

In the March and September 1918 issues of MOTORSHIP, or five years ago, we published some articles on tests of Tosi oil-engines. The builders have just written us for a large number of reprints, indicating that even after many years our editorial material is of value.

A 6,500 tons d. w. motor tanker to have Fijenoord-Augsburg Diesel engines has been ordered by the Stoomvaart Mij. de Maas (Ph. Van Ommeren Jr.) of Rotterdam, from the Fijenoord Shipbuilding Co., of the same city. The oil-engines will be built under M. A. N. license.

Two 128 tons gross motor-vessels propelled by twin four-cylinder 11 in. by 12 3/16 in. Sulzer Diesel engines (about 250 b. h. p. each) are being built for the Cia. Anendataria de Tabacos, by the Cia. Euskalduna de Construccion of Bilbao, Spain, length 106 ft., breadth 17 ft. 1 in., depth 8 ft. 1 in.

LUCIENNE, the 420 h. p. Sulzer Diesel-engined tug owned by Wallace, of Vancouver, which recently crossed the Atlantic, has now been renamed NORSHORE.

A rush of oil-engine business is expected in Japan, as about 60 steam tugs were burned up in Yokohama during the recent terrible earthquake and fire. Had these vessels been built to raise steam quickly, they could have gotten away. They will be replaced by oil-engined boats which are available at a moment's notice.

For the construction of 19 motorships on the Clyde, loans of £1,800,000 (or about $7,850,000 at the current exchange rates) have been guaranteed to the Scottish shipbuilders by the British Government under the Trades Facilities Act.

Possibly every American oil-engine builder wishes what a weekly shipping contemporary recently stated was true, viz,— "Another expert who is in a position to know conditions — remarks NAUTICAL GAZZETTE, the publication in question — states that the leading Diesel engine manufacturers have enough work ahead of them to keep them busy for the next two years and their plants cannot handle machinery for more than a few ships at once. This was in reference to the Shipping Board's scheme for converting steamer hulls to Diesel power.

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SAM, EX-FULRIO, a 800 tons motorship owned by S. Svendsen of Brevik, Norway, recently sank in 160 feet of water when loaded with coal and coke.

Simultaneously with the decrease of 100 steamers and sailing-vessels in Norway, motorships have increased to no small degree according to recently issued official statistics.

The low fuel consumption of 0.385 lb. per shaft h.p. hour was attained by one of the 1,700 s.h.p. at 85 r.p.m. Sulzer two-cycle Diesel engines of the m. s. CAMRANH on the test bed. The blower was driven by a separate electric motor.

A review of Lloyds' Register show that the average life of a merchant steamer is 14 to 15 years. Why then all this fuss over the question of the life of a Diesel engine. The motorships VULCANUS and SELANDIA built in 1911 and 1912 respectively, are running as merrily as ever.

Trials were recently run of the 90 ft. tug JAMES W., which is the latest oil-engined addition to the Shaver Transportation Co.'s fleet in Portland Harbor, Ore. A six-cylinder Atlas-Imperial Fiesel engine turning a 64 in. diam. by 51.2 in. pitch propeller at 280 r.p.m. powers this boat and drives her at 12 knots.

Since the war the Deutsche Werke, at Kiel, have constructed, among many other ships, five motorships, including one of 11,250 tons d.w.c. and another of 8,000 tons d.w.c.; 29 oil-engined fishing vessels and eight motor-yachts. Diesel engines in 10 sizes are included in their output, as well as a small surface-ignition oil-engine.

John Kincaids, of Greenock, Scotland, have just completed a Diesel engine which develops 1,150 shaft h.p. at the low-speed of 65 r.p.m. It is of Harland & Wolff-Burmeister & Wain design in six cylinders 630 mm. (24.80 in.) bore by 1,300 mm. (51.18 in.) stroke. It is for a British motorship that will have steam deck machinery.

As an instance of the rapidly approaching "boom" in oil-engine construction in the United States, the Ingersoll-Rand Company's capacity for oil-engine construction is almost completely taken up by orders on hand for marine and stationary sets. Incidently, the past year has been a record one in the history of the Fairbanks-Morse oil-engine.

To the order of the South Taranaki Shipping Co. (F. W. Granger, Mgr. Owner) of Wellington, N. Z., the 251 tons coastwise motorship INAHA was recently delivered by a Scottish shipyard. Two 3-cylinder, two-cycle 13 3/16 in. by 13 13/16 in. Plenty surface-ignition oil-engines are installed. Length 108 ft., breadth 23 ft. 1 in., depth 9 ft. 1 in.

For the German-Russian Transport Co. (A. Bernstein, Managing-owner) an 822 gross tons twin-screw motorship named CHAMADAN was recently built at the Deutsche Werke, Rüstringen, Germany. In this vessel two four-cylinder 11 3/8 in. by 17 in. Benz oil-engines have been fitted. Length 222 ft., breadth 31 ft. 8 in., depth 11 ft. 6 in.

If you would like to have three useful and instructive books on the construction and operation of Bolinder oil-engines, just write to the Bolinder Engine Co., Inc., 30 Church St., New York City, mentioning MOTORSHIP, and a copy of each will be sent you. One of these books incorporates instructions regarding the new Bolinder electrical cold starting device.

When in the United States and Canada for several months this past Fall, John McGovern, managing-director of the Furness Shipbuilding Company, Middlesbrough, England, secured contracts for seven vessels. Five are 130 ft. tank barges for the Imperial Oil Company, Toronto (Standard Oil interests), and two are 2,600 tons steamers for the Canadian S. S. Line.

The second pair of 800 b. h. p. McIntosh & Seymour Diesel engines for the Port of Portland, Ore., for installation in a Diesel-electric driven 30 in. dredge are about to be delivered from Auburn in the early spring. It will be recalled that the Port of Portland has a Diesel-electric dredge with two 900 b. h. p. McIntosh & Seymour Diesel engines, which were bought from the Shipping Board and changed from reversible engines to deliver 750 shaft h. p.

Burmeister & Wain, the Danish motorship builders, are continually receiving additional orders, the latest being two 8,000 tons D. W. motorships and one 6,000 tons motorship from the Gunnar Knudsen Steamship Co. of Porsgrund, Norway. It was only recently that B. & W. took an order from the Klosters Co. of Kristiania for two 10,000 tons motorships, aside from the 1,400 h.p. 167-ft. Diesel yacht from Frederick Vanderbilt of New York.

A four-cylinder 10 3/5 in. by 12 3/5 in. Bellanger oil-engine has been installed in the trawler LIEUT. ROBERT COUTURIER, owned by the Pecheries de Normandie, of Fécamp, France. A similar engine has been fitted in the trawler LITTORAL, owned by Marcel Carpier, of St. Malo, as well as in the trawler RENE MARGUERITE owned by the Soc. Anom. de Carrières de l'Ouest, of St. Malo. All these boats are of 185 gross tons, 101 ft. 4 in. in length, 25 ft. 2 in. breadth and 11 ft. 5 in. depth.

After Mr. A. S. Hebble, Superintendent-Engineer of the Southern-Pacific S. S. Co. had visited the principle Diesel engine factories in Europe, his company place a contract with the Todd Shipyards Corp. for a $2,000,000 cargo-passenger steamer of 11,00 tons displacement and 6,000 h.p., apparently because they were not convinced that Diesel engines would burn the heavy Mexican oil obtained from their own wells at low cost, and if they adopted fuel-oil they would be compelled to buy the higher priced fuel-oil in the open market.

Recently the Bolinder-engined tug CZAR, of Vancouver, struck a rock in Smith Inlet, B. C. and sank. Later the salvage steamer ALGERINE, en route to the rescue of the KENNECOTT, came alongside and pumped the water out of the CZAR, bringing her to the surface. Two patches were put on the tug's hull, and the CZAR was towed a distance of 150 miles to Vancouver by a steam tug. On the way back the steam tug blew out a couple of water tubes and became disabled . The Bolinder engine of the CZAR was then started up and towed the steam tug to port, although the Bolinder oil-engine had been completely submerged in water.

NORTH EASTERN-WERKSPOOR ENGINED MOTORSHIP "WELLFIELD" LAUNCHED

Will Utilize Waste Exhaust-Gases for Auxiliary Power

Hunting & Son's (Newcastle-on-Tyne) 7,900 tons motorship WELLFIELD was launched December 8th at the yard of the Tyne Iron Shipbuilding Co., Wilmington Quay-on-Tyne. She is built to the Isherwood system and is 385 ft. long with 51 ft. 3 in. breadth and 30 ft. 6 in. depth. She has steam deck auxiliaries, but propelling power is furnished by a pair of 550 mm. (21.65 ins.) bore by 1,000 mm. 39.37 ins.) stroke North Eastern-built Werkspoor four-cycle Diesel engines of 1,450 h.p. each, designed to drive the ship at 11 knots. The waste exhaust gases in conjunction with oil burners are utilized for firing two multi-tube boilers.

At the launch Capt. P. L. Hunting, of Hunting & Sons, the owners, said that when they ordered the motorship WELLFIELD they were told by some wiseacres, and were still being told, that the Diesel engine was in the experimental stage, and that where fools rushed in angels feared to tread. Whether they proved to be angels or otherwise rested with the engine builders. Personally he knew the reputation of the Werkspoor type of engine and the reputation of the licensees in Great Britain, and having seen the engines building and on trial he had little fear about the result.

We have an idea that oil-engine operation data published in MOTORSHIP may have had some influence in the decision of the WELLFIELD'S owners to adopt Diesel power, as some time before the WELLFIELD was contracted for, Hunting & Co. subscribed to this magazine.

J. F. Mulherion, managing-director of the Tyne shipyard referred to the work done by the North Eastern Co. in developing cast-iron for Diesel engine construction. There was no doubt that when the Diesel engine was introduced ten or twelve years ago the cast-iron cylinders and heads gave a great deal of trouble, and it was more or less a rule of thumb or skill on the part of the workman. Summers Hunter of the North Eastern Co., however, had developed the necessary metal to a high degree, and they had every reason to be proud of the result. He produced a piece of cast-iron which twisted like steel, and remarked that it was a testimony to Mr. Summers Hunter's experimenting.

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